

ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

FOR THE PROPOSED ESTABLISHMENT OF AN
ISLAND WASTE AND RESOURCE MANAGEMENT
CENTRE IN TH. MADIFUSHI



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*Prepared for: Ministry of Environment, Climate Change
and Technology*

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DECLARATION OF THE AUTHOR

I hereby declare that the information provided in this ESMP are true, complete and accurate to the best of my knowledge and is based on the information available at the time of writing.



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NON-TECHNICAL SUMMARY

The proposed project for the established of an Island Waste and Resource Management Centre (IWRMC) in Th. Madifushi, is funded by the World Bank and executed through the Maldives Clean Environment Project (MCEP). The aim of the project is to construct a proper IWRMC in the island, with in-vessel composting technology to treat the organic waste generated, coupled with creating adequate waste processing and storage facilities to facilitate volume reduction of inorganic waste. The IWRMC will also have administrative buildings such as an office, store, locker, toilet and resting areas, while provisions will be made to install fire safety equipment.

Th. Madifushi has a demarcated area for dumping waste where waste can be segregated and stockpiled. This 3000 sqft dumpsite is now close to reaching its capacity due to lack of volume reduction machinery and transportation of waste. Green waste is burnt on site, and kitchen waste is dumped into the lagoon area. Th. Madifushi Council has formulated an Island Waste Management Plan which is yet to be approved by the EPA.

The proposed IWRMC under the current project is located in the southern end of the island at the newly reclaimed area. No vegetation clearing is required for this plot, and the plot is easily accessible. It is to be noted that the initial IWRMC site was approved by Maldives Land and Survey Authority (MLSA) in 2017 and an Environmental and Social Management Plan (ESMP) was subsequently prepared and cleared for project in 2021. However, after selection of a contractor and their mobilisation to the site, the proponent was informed about the RO plant location being changed to the IWRMC site with civil works currently in progress. Therefore, after a series of discussions with relevant stakeholders, the IWRMC site was decided to be shifted 47m east of the previous site. Zonal approval from Ministry of National Planning, Housing and Infrastructure (MNPHI) was attained for the relocated site.

The main activities involving the construction of the IWRMC include shallow excavation, substructure and superstructure works as well as masonry works. The proposed design of the IWRMC requires a shallow foundation due to the structure being a single-storey structure. After the structural works are done, masonry, plastering, roofing works are completed prior to the addition of the services components such as electricity, fire-fighting and plumbing. The construction phase of the project is expected to be completed within 12-24 weeks.

The operational phase of the project would mainly include waste collection from households, institutions, and public spaces, sorting, volume reduction and stockpiling of re-usable, recyclables, composting of organics, and storage of hazardous waste.

This ESMP will cover both the construction and operational aspects of the IWRMC.

Key Impacts

Environmental and Social Impacts of the project was evaluated using a modified Leopold matrix. It was found that the project will result in certain minor and moderate impacts both during the construction and the operational phase of the project. The main project activities which may result in impacts during the construction phase include; influx and settlement of workers for the project construction activities, transportation of materials, impacts from construction works, terrestrial

pollution from construction waste generation and impacts from resource use. However, irreversible permanent negative impacts are not envisaged, as the project does not involve removal of any vegetation.

The main project activities during the operational phase which may have a significant impact on the environment include waste collection and transportation, waste management activities, waste generation - terrestrial pollution, groundwater contamination and resource consumption.

The major socioeconomic impact is found to be positive. The reduced volume of solid waste accumulated will have public health benefits for the residents of Th. Madifushi.

Impacts and Mitigation Measure

An Environmental and Social Management Plan has been proposed with mitigation measures and estimated cost for implementing the proposed mitigation measures.

Alternative Technology and Energy Sources

Alternative technologies for managing organic waste has been analysed. The technologies compared include manual composting (open windrow system), anaerobic digestion system (bio-gas generation) and aerobic OWC technology (in-vessel composting). From the analysis, the aerobic OWC technology was found to be most appropriate for the IWRMC in Th. Madifushi, due the simplicity of the technology, being less labour intensive, taking comparatively less land area for installation of the machine and significantly reducing processing time, thereby increasing avenue for making the IWRMC self-sustainable.

Similarly, alternative energy sources were analysed in terms of installing solar and a diesel generator specific to the IWRMC. These alternatives were compared with the proposed option of connecting electricity from the existing power grid of Madifushi. Although solar is the most beneficial from an environmental and social perspective, the proposed option is found to be the most advantages due to the high cost of installing solar, coupled with budgetary limitations.

Environmental Management and Monitoring

A monitoring regime of environmental and social safeguards has been proposed taking into consideration the impacts and mitigation measures to be implemented. The important elements that require checks such as implementation of mitigation measures, groundwater quality and spillage assessment at the project site will be monitored according to the developed monitoring program during construction and operation period.

Although the project involves inevitable negative environmental impacts, such impacts are not serving as to not undertake the project. Mitigation measures have been proposed to adequately minimize the significant impacts. Hence, the project is justifiable in light of the socioeconomic conditions and anticipated benefits from the project which clearly outweigh the negative environmental impacts.

Overall, the project is expected to provide significant socio-economic and environmental benefits for the local community.

ში, ხსენებული ნაწილის დასრულებასთან დაკავშირებით, მნიშვნელოვან წარმატებას აღწერიდა. ... 4 დარგში 6 დარგის მიხედვით, მნიშვნელოვანი წარმატება აღინიშნა.

ინტელექტუალური უნარების განვითარება და უწყვეტი განათლების მიწოდება ... 3000 სტუდენტისთვის ...

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האגודה מכירה ומוכרת את שירותיה כשירותים שאינם ניתנים להעברת זכויות השימוש בהם למי שאינו חברה באגודה. על אף שישנה חשיבות רבה לשירותים הניתנים על ידי האגודה, אין להעביר את זכויות השימוש בהם למי שאינו חברה באגודה.

האגודה אינה נשאת באחריות כלשהי לגבי הישגות או נזקים כלשהם שנגרמו או עלולים להיגרם כתוצאה מהשימוש בשירותיה.

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CHAPTER 1 INTRODUCTION

1.1. Project Background

Solid Waste Management (SWM) is a priority sector for the Maldives due to the fact of high economic and social dependence on a healthy marine environment. In recent years there has been a significant increase in the magnitude of waste management problems throughout the country for a number of reasons, including but not limited to population increase, changing lifestyle, dependence on importation, coupled with the environmental challenges brought about by the growing tourism. The worsening waste management situation is increasingly resulting in pollution of the environment and the generation of conditions prejudicial to public health. Practices vary from community to community, but at most islands waste is building up into many open dump sites spreading across islands and disposed of either in the sea or by open burning. Predicting the threats to the economic development, the Government of Maldives (GoM) took a decision to invest heavily in the waste sector with the support of various donors and international agencies to build the necessary infrastructure to develop an integrated and sustainable solid waste management system throughout the country on a Zonal approach.

This process has started in 2008 with the support of the World Bank Group, under the International Development Association (IDA) credit to develop an integrated SWM system for Zone II, namely the Maldives Environmental Management Project (MEMP). This project has been completed in 2015, by developing SWM systems at the island's level and a regional waste treatment facility for final disposal of residual wastes from Zone 2 islands.

Following the completion of the MEMP and the design implemented, the GoM received another grant from the IDA for another regional waste management project under the title "Maldives Clean Environment Project" (MCEP). The project includes providing support to establish and operate SWM systems in Zones IV and V, including island waste management systems, based on a detailed feasibility study that will be completed under the project.

Phase 1 of the technical and financial feasibility study (FS) for the regional waste management of Zone 4&5 was completed and cleared by the World Bank on September 2019. Upon completion of phase one and delivery of partially completed Island Waste Management Systems report which informs the preliminary requirements for island level component, the project has received go ahead from the World Bank to commence construction of IWRMCs. Based on the population and the size of the islands, 2 distinguished types of technologies are proposed to deal with the organic component of the island waste stream, namely, anaerobic digestion and mechanical aerobic technology (using a mechanized compost machine / in-vessel composting).

To facilitate systematic implementation of the island level subcomponents, 19 of the subproject islands in Zone 4&5 were grouped into batches, depending on the respective size, population and waste generation estimates of the islands coupled with the level and scope of works to be carried out. This includes:

- 8 Pilot Projects proposed to determine the feasibility of Anaerobic Digestion and Mechanical Composting in a country specific context; and
- Establishing 11 new IWRMCs with mechanical composting technology.

The proposed project for the establishment of Th. Madifushi Waste and Resource Management Centre (WRMC) includes construction a 750sqm centre to facilitate mechanical composting, and inorganic waste processing through compaction, baling and crushing. Equipment (glass crusher, multipurpose baler, dustbins, weighing scale, consumables etc.) and collection vehicle (2-ton pickup with tail gate lifting mechanism) will be provided through the project as support to undertake the required operational activities at the centre.

An ESMP report was prepared in 2018 for the initial scope (ESMP 2018) and subsequently cleared by the EPA (on 2 August 2018) and World Bank. The report was prepared by Environmental Consultant, Mr. Ahmed Saleem, hired by MCEP. However, due to delays in the delivery of the FS, construction of the IWRMC was put on hold. The technology reflected in the ESMP was open windrow composting, which was later changed to mechanical composting (also known as in vessel composting) based on the findings of the FS, including certain design variations brought to the overall design of the IWRMC.

Taking the aforementioned into consideration, the ESMP was updated in 2021 by MCEP's Environmental and Social Safeguards Specialist, Ahmed Hassaan Zuhair (ESMP 2021) and re-cleared by the EPA (on 24 February 2021) and the World Bank. The decision statement issued by EPA to the ESMP was extended by an additional year upon request from the proponent. However, awarding of the project got unexpectedly delayed due to several unsuccessful tenders.

Elite International Pvt. Ltd. was selected as the contractor for the project after competitive bidding process. The contract was signed on 19 April 2023 and the contractor mobilised to the site on 1 May 2023 as per the conditions of the contract. However, upon mobilization of the contractor to the site, it was found that a Reverse Osmosis (RO) plant building was recently constructed at the Maldives Land and Survey Authority (MLSA) approved IWRMC site. After series of discussions by the project proponent with the Projects Section of Ministry of National Planning, Housing and Infrastructure (MNPHI - proponent of water supply system project) and their Urban Planning Department, MLSA, EPA, and Th. Madifushi Council, a way forward was agreed, as to relocate the IWRMC site to the east of the original site, obtain zonal approval to this site from Urban Planning, and update the previously approved ESMP reflecting these changes. No objection from the World Bank was also attained for the agreed way forward.

The new site is located 47m east of the original site (RO plant building) at the reclaimed area of the island. Therefore, the existing environment will be similar to the previous site, and thus, the impacts and mitigation measures are envisaged to remain the same. MNPHI issued zonal approval for the new WRMC site on 18 May 2023.

1.2. The Project Island

This report is focused on Th. Madifushi, which is one of the inhabited islands of Thaa atoll located at 02°21'20"N and 73°21'10"E. Situated on the eastern side of the atoll the island covers an area of about 19.5 ha naturally. The island is undergoing reclamation which is in its final stages. The reclamation adds an addition 20 ha which makes the island's total area into approximately 40 ha. Along with this, construction of the new harbour works is also underway. The newly constructed harbour is 800 x 300 ft in size. The island has a population of 856 people and was one of the islands severely devastated during the 2004 tsunami. The nearest inhabited island is Dhiyamigili on the southwestern side of Madifushi and is roughly 2.65 km away. The nearest uninhabited island is Ufuriyaa just 0.28 km away. COMO Maalifushi in Maalifushi is the closest resort to the island 9.16 km away. Moreover, the closest airport is in Thimarafushi located on the southern region of the atoll.

The island has 24-hour electricity service and a central sewerage system. The island has a health centre and education provided up to grade 10.

1.3. Environmental and Social Management Plan and Environmental Permits

The Maldives national requirements for Environmental Impact Assessment are set out in the Environmental Impact Assessment (EIA) Regulations, 2012. Part III of this regulation includes a description of the Screening Process applied to development proposals. Schedule D of the Regulations provides a screening list of all development types for which full EIA is mandatory. According to Schedule D included in Amendment 2 to the EIA regulations 2012, waste management practices that require preparation of an EIA are:

1. Projects involving operation of large incinerators with a capacity of more than 10 tons per day.
2. Development of large waste management centres that treats more than 10 tons of waste per day.
3. Projects that involve development of a landfill by using waste.

Proposed developments that do not fall within Schedule D are subject to manual screening by the Environmental Protection Agency (EPA), for which a Screening Form must be submitted providing relevant development details. Within 10 days, the EPA will decide whether the proposed development is approved, or needs further study, which may be required in the form of an EIA or Environmental Management Plan (EMP) (Ministry of Environment, Climate Change and Technology [MoECCT], 2012).

The proposed development is small scale and therefore is not listed under the Schedule D of the EIA Regulation. A screening process was followed for the initial project, where the screening decision from EPA was to prepare an EMP for the project and to submit for review and approval. The screening decision from EPA is provided in **Annex 1** of this report.

It is mentioned in the Environmental and Social Assessment and Management Framework (ESAMF) of MCEP that prior to the approval of disbursement of funds for project sub-components,

International Development Association (IDA) will have to clear all safeguards documentation. Therefore, although an EMP is required as per the local regulation, an Environmental and Social Management Plan (ESMP) was developed for the project and later updated.

ESMP 2021 was prepared for the MLSA approved original project site. The Decision Statement (DS) and clearance note issued for the ESMP are provided in **Annex 2**.

Both the implementing and funding agencies were later consulted regarding the change in location of the original project, where the decision received from both the institutions were to update relevant sections of the previously cleared ESMP 2021 and resubmit for further review and clearance. Both the institutions acknowledged that the impacts and mitigation measures will remain exactly the same, considering the new site being similar to the original site, which is also located at the reclaimed area of the island devoid of any vegetation. Supporting evidence confirming this is provided in **Annex 3**.

Zonal approval obtained from Urban Planning Department of MNPHI to the new site is provided in in **Annex 4**.

Other major laws, regulations and policies applicable to this project (both national and the World Bank) are reflected in **Table 1**.

Table 1 Laws applicable to the project

#	Relevant laws, regulations, policies and guidelines	Requirement	Application specific to project
1	Waste Management Act (Law No. 24/2022)	National	<p>On 18th December 2022, Maldives enacted the Waste Management Act [Law no. 24/2022].</p> <p>The Act specifies the standards and procedures for sustainable waste management and governs the implementation and enforcement of practices and regulations designed to reduce the harmful effects of waste and safeguard public health.</p> <p>The law’s objectives include decreasing waste-related environmental pollution and health risks to the general public, minimizing waste, and promoting waste recycling and reuse.</p> <p>The act also provides a mechanism to reduce single-use plastics (SUPs). Under the Act, a fee of MVR 2 is to be charged for plastic bags except in the following circumstances. (1) Plastic bags sold or supplied by duty-free shops. (2) Unsealed bags used for fresh meat. (3) “Bin liner” sold exclusively for waste disposal by waste management service providers or by other relevant agencies.</p>

			<p>A fine of up to MVR 5 million may be incurred for illegally importing waste or exporting hazardous waste.</p> <p>A waste reduction strategy is to be developed within 12-months from the commencement of the Act.</p>
2	National Waste Management Policy 2015	National	The establishment of an IWRMC is prerequisite to facilitate waste management at island level.
3	Waste Management Regulation	National	<ul style="list-style-type: none"> • The regulation reflects the following: <ul style="list-style-type: none"> - Sets standards for waste collection, transfer, treatment, storage, waste site management, landfills and managing hazardous waste. - Defines approval procedures for waste sites and waste transfer. - Standards and permits required for waste transport on land and sea, including transboundary movements. - Defines reporting and monitoring requirements and procedures. - Defines procedures to implement WMR and penalties for non-compliance. • The IWRMC was designed conforming to the provisions of Waste Management Regulation. • As per section 6-2 of the 5th amendment to the waste management regulation, all inhabited islands, cities, tourism related island and resorts except Male' city should segregate their waste in the minimum following categories: <ol style="list-style-type: none"> a) Organic and self-disposable waste b) Plastic bottle c) Metal and glass d) Other waste excluding waste types indicated above. • The 5th amendment further states that the categories of waste specified should not be mixed with bulky waste (i.e., furniture, appliances, fridge, TV, washing machine, etc.). Bulky waste should be disposed on days and method specified by the City or Island Councils. It is also mentioned that if waste is not segregated as per the 5th amendment, the waste management service providers have the right to refuse collection.
4	National Policy on Health Care Waste Management	National	<ul style="list-style-type: none"> • Stipulates that all health facilities have to be responsible for the safe management of health care waste in an environmentally sound manner that minimizes risk to the community and the staff involved in its management.

			<ul style="list-style-type: none"> The IWRMC should not accept healthcare waste as it has to be managed separate from the general waste directly at the health centre.
5	Maldives Land Act	National	<ul style="list-style-type: none"> The Act governs allocation of Maldivian land for different purposes and uses and other issues regarding the issuing of land, issuing of state dwellings or private dwellings constructed for residential purposes and the sale, transfer and lease of Maldivian Land. Under article 2, all transactions concerning issuing, receiving, owning, selling, lease, utilizing and using Maldivian land shall be conducted in compliance with this Act. The draft Land Use Plan (LUP) of Th. Madifushi was prepared by the island council on 28th October 2022, which is yet to be endorsed by MNPHI. However, a zonal approval for the relocated IWRMC site was issued by MNPHI upon request from the Island Council.
6	Decentralisation Act	National	<ul style="list-style-type: none"> Under the Decentralisation Act, the local councils are mandated to prepare land use plans. The act states that within three months after the elected members assume office, the island council shall prepare the development plan and land use plan of each island with technical assistance provided by the Atoll Council. Madifushi Council has prepared a draft Land Use Plan (LUP) in consultation with the island community on 28th October 2022 which is yet to be approved by MNPHI. The LUP was prepared through Riyan Pvt Ltd. However, a zonal approval for the relocated IWRMC site was issued by MNPHI upon request from the Island Council.
7	Environmental Guidelines for Site Selection of Waste Management Centres (2017)	National	<ul style="list-style-type: none"> Provides recommendation for optimum zoning of IWRMC sites. No environmentally or socially sensitive areas are present within a 30m boundary from the IWRMC.
8	Coral mining regulation	National	Coral mining from house reef and atoll rim is banned.
9	Sand mining regulation	National	Sand should not be mined from any part of an inhabited island, beach or the newly reclaimed island beach. Sand should also not be mined from within 100 ft. of the shoreline.
10	Law on Cultural and Historical Places and Objects of the Maldives (27/79) WB PS8 (2012)	National World Bank	Requires client to develop provisions for managing chance finds through 'a chance find procedure' which will be applied in the event that cultural heritage is subsequently discovered. The client shall not disturb

			any chance find further until an assessment by competent professionals is made.
11	World Bank Group Environmental Health and Safety Guidelines for SWM Facilities	World Bank	Sets procedures to reduce the risk of accidents and injuries, minimize dust and air quality related impacts, reduce the probability spillage of oil and hazardous substances and leachate on site due to stormwater run-off during operations of waste management facilities.
12	Employment Act (02/08)	National	<ul style="list-style-type: none"> • Worker shall not be forced to work for more than 48 hours per week. • Workers shall not be made to work for more than 6 days a week consecutively without providing 24 hours for rest. • Workers shall not be made to work continuously for more than 5 hours without providing a break for at least 30 minutes. • Salary should be paid to all permanent contract workers once a month. • Minimum 03 meals shall be provided to construction staff per day or appropriate meal break time shall be provided.
13	Immigration Act (01/07)	National	<ul style="list-style-type: none"> • All expatriate workers must have proper work visas and work permit cards.
14	Utility Regulation Authority Act (2020)	National	<ul style="list-style-type: none"> • The regulatory works for waste management has been transferred to newly established Utility Regulation Authority (URA).

1.4. Objective of the ESMP

The objective of the ESMP study is:

- a) To provide the ways by which the proponent will manage and control the works associated with the construction and operation of the IWRMC;
- b) to provide an assessment of the potential environmental and social effects of the proposal and determine which of these, if any are likely to result in a significant effect on the environment and to propose ways and means of avoiding, mitigating, and or compensating the perceived negative effects of the project;
- c) enhance project benefits; and
- d) to provide necessary information to EPA and the World Bank applicable to the proposed development in line with the EIA Regulations and the ESAMF.

1.5. ESMP Implementing Process

In general, the objective of an ESMP report is to address the environmental and social concerns of the developmental project. The ESMP report will also help to promote informed environmental and sound decision making during the development of the project.

The aim of the ESMP is to identify, describe and assess in an appropriate manner, proposed development, in accordance with the provisions of guidelines and regulations of the GoM, the direct, indirect and residual effects of the project on the physical, biological and social environment of project. The ESMP would also provide the ways by which the proponent and the island council will manage and control the works associated with the construction and operation of the IWRMC.

This ESMP has been developed within the framework outlined in the EIA regulations 2012 (in addition to the Environmental and Social Assessment and Management Framework (ESAMF) of MCEP and the TOR cleared by the World Bank. This ESMP establishes the environmental management controls to be followed by the contractor, its employees, subcontractors and sub consultants in carrying out the construction and operation of the IWRMC.

Once the decision notes are issued from EPA and the World Bank the proponent is obligated to implement the ESMP and matters highlighted in these documents.

1.6. Desk Study Review

A literature review was conducted to acquire background information related to the site and the general environment of the island, as well as to identify possible environmental impacts of projects of similar settings. In this context, the following documents were reviewed:

- ESMP for the establishment of an Island Waste and Resource Management Centre in Th. Madifushi (Zuhair, 2021)
- ESMP for the establishment of Island Waste Management Centre in Th. Madifushi (Saleem, 2018).
- ESMP for the proposed upgrading of Island Waste Management Centre in N. Holhudhoo (Zuhair, 2019a).
- EMP for the proposed development of Island Waste Management Centre in R. Maakurathu (Zuhair, 2019b).
- Draft Updated ESMP for Establishment of IWRMC in M. Mulah (Hamdhoon, 2021).
- EMP for upgrading Island Waste Management Centre in Fuvahmulah (Zuhair, 2016a).
- EMP for upgrading Island Waste Management Centre in Hulhudhoo-Meedhoo (Zuhair, 2016b).
- Maldives Clean Environment Project Environmental and Social Assessment and Management Framework (ESAMF) & Resettlement Policy Framework (RPF) (Ministry of Environment, Climate Change and Technology [MoECCT], 2016).
- Draft Island Waste Management Plan of Th. Madifushi (Madifushi Council, 2020).

- Environmental, Health, and Safety Guidelines for Waste Management Facilities (World Bank Group [WBG], 2007).
- Operational Environmental and Social Management Plan for RWMF – Zone 2, Vandhoo, Raa Atoll (Zuhair, 2018).

1.7. Report Preparation and Acknowledgement

This report is prepared by Mr. Ahmed Hassaan Zuhair, the Environmental and Social Safeguards Specialist of MCEP. According to the second and third amendments to EIA regulations 2012, ESMP reports can be prepared by anyone with a minimum educational qualification of first degree in a field related to environment and do not necessarily have to be an EIA consultant registered in EPA. The educational certificates and curriculum vitae of the author is provided in **Annex 5**.

The following parts of the ESMP report were updated;

- Summaries of newly formulated regulations relevant to the project were added.
- The Project Description chapter was updated with relevant information on the new project site, storeroom arranged to ensure temporary safe storage of contractor's materials and tools, and updated list of machinery and equipment to be provided to facilitate centre operations, considering the most recent developments.
- The Existing Environment chapter was updated to reflect the revised project site and surrounding areas. As such, distances of significant areas (revetment, residential area, public places, distribution box etc.) in relation to project site were updated and provided. Waste generation estimates and socio-economic environment were also updated based on the recently published census 2022 data.
- Further stakeholder consultations were carried out with MNPHI, MLSA, EPA and Madifushi Council regarding the proposed relocation of the IWRMC site and any additional permits that are required to be taken as a result of it.
- The public perception survey carried out during the formulation of ESMP 2021 was repeated. The survey form was updated as required.
- Information on GRM was updated, reflecting the level of on the ground implementation.
- Executive Summary, Introduction and Conclusions were revised accordingly. Dhivehi translations of the executive summary was provided.

Some sections have been retained from the original report. This primarily includes parts of the impact identification chapter, specifically the methodology used for impact identification and assigning significance level.

In preparing the report the author was assisted by a multi-disciplinary team of experts and wish to acknowledge their invaluable input in preparing the report. The author would also like to acknowledge the consultant of the ESMP 2018, Mr. Ahmed Saleem, who had produced a quite compressive report initially, where parts of this reports are used in this revision as stated above. The

team members, their respective field of expertise and areas of contribution to the assessment is given in **Table 2**.

Table 2 The ESMP Team

Name	Qualification	Designation/Field of Expertise	Contributing Area
Mr. Ahmed Hassaan Zuhair	Master of Urban & Environmental Planning, Griffith University.	Author, ESMP Consultant	<ul style="list-style-type: none"> • Overall administration of the ESMP preparation and writing of the report. • Chapter revisions. • Preparation and finalization of the online public survey, including obtaining clearance from the World Bank for the survey from. • Report compilation.
Mr. Ahmed Bunyameen	GECE Advanced Level	Data Collection	<ul style="list-style-type: none"> • Baseline data collection • Data collection for public survey
Ms. Aishath Ajfaan Jawaad	Master of Public Administration Bachelor of Environmental Management	Administrative Support	<ul style="list-style-type: none"> • Travel arrangement for data collection visit. • Organising stakeholder consultation meetings. • Preparing meeting minutes.

CHAPTER 2 PROJECT DESCRIPTION

2.1. Project Setting

Th. Madifushi is located at 02°21'20"N and 73°21'10"E. Situated on the eastern side of the atoll the island covers an area of about 19.5 ha naturally. The nearest inhabited island is Dhiyamigili on the southwestern side of Madifushi and is roughly 2.65 km away. The nearest uninhabited island is Ufuriyaa just 0.28 km away. COMO Maalifushi in Maalifushi is the closest resort to the island 9.16 km away. Moreover, the closest airport is in Thimarafushi located on the southern region of the atoll.

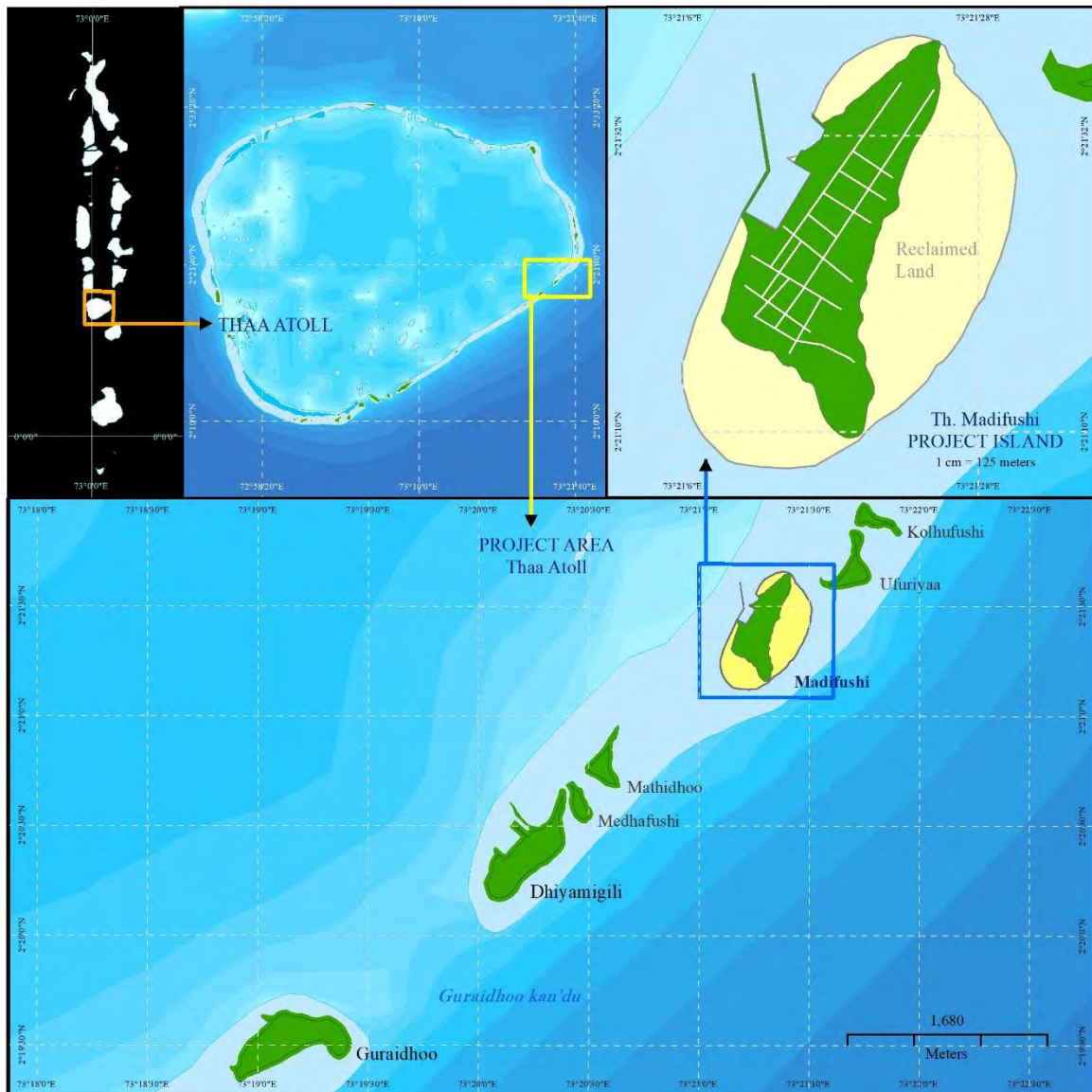


Figure 1 Project Setting

2.2. Site Location

The relocated IWRMC site is at the southern side of the island, 47m east of the original site, where RO plant building works are currently on-going. The land has been recently reclaimed. There is no vegetation at the site. The site is easily accessible. A3 scaled study area map is provided in **Annex 6**.

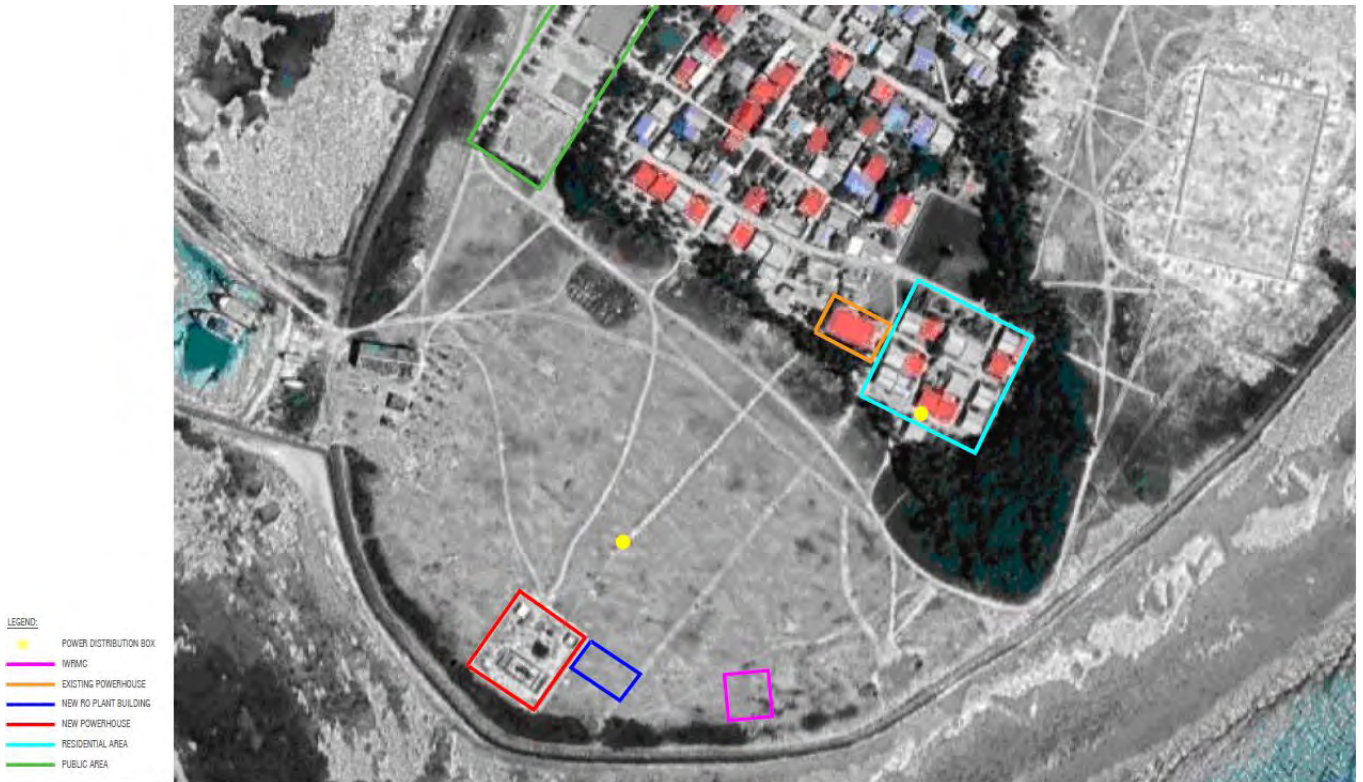


Figure 2 Study Area

2.3. The Proponent

The Proponent of the project is Ministry of Environment, Climate Change and Technology (MoECCT) of the Government of the Maldives (GoM).

2.4. Project Duration and Schedule

The construction works of the proposed project is expected to be carried out in 12-24 weeks. A tentative schedule of the shortest work duration is found in **Table 3**.

Table 3 Tentative work plan for IWRMC

#	Activity	Weeks												
		1	2	3	4	5	6	7	8	9	10	11	12	
1	Mobilization	■												
2	Site clearing		■											
3	Excavation works			■										
4	Substructure and superstructure work				■	■	■							
5	Masonry works						■							
6	Plastering works							■	■					
7	Roofing works								■					
8	Structural steel works									■				
9	Electrical works										■			
10	Plumbing works											■		
11	Doors and windows												■	
12	Demobilization													■

2.5. Project Description

A-3 sized layout of the IWRMC is provided in **Annex 7**, with a scaled down version presented in **Figure 3**.

The development of the IWRMC consists initially of site selection, site approval, mobilization, followed by site construction. Site clearance is not required since the site is located in a newly reclaimed land devoid of any vegetation or undergrowth. The works include shallow excavation, substructure and superstructure works as well as masonry works. The proposed design of the IWRMC requires a shallow foundation due to the structure being a single storey structure. After the structural works are done, masonry, plastering, roofing works are completed prior to the addition of the services components such as electricity and plumbing.

The operational phase of the project will include the daily collection of waste from the households and institutions, in addition to waste management works in the IWRMC, which include;

- Sorting of waste;
- Storing of hazardous waste;
- Volume reduction of plastics, glass and metals;
- Stockpiling of sorted waste; and
- Composting of organic waste.

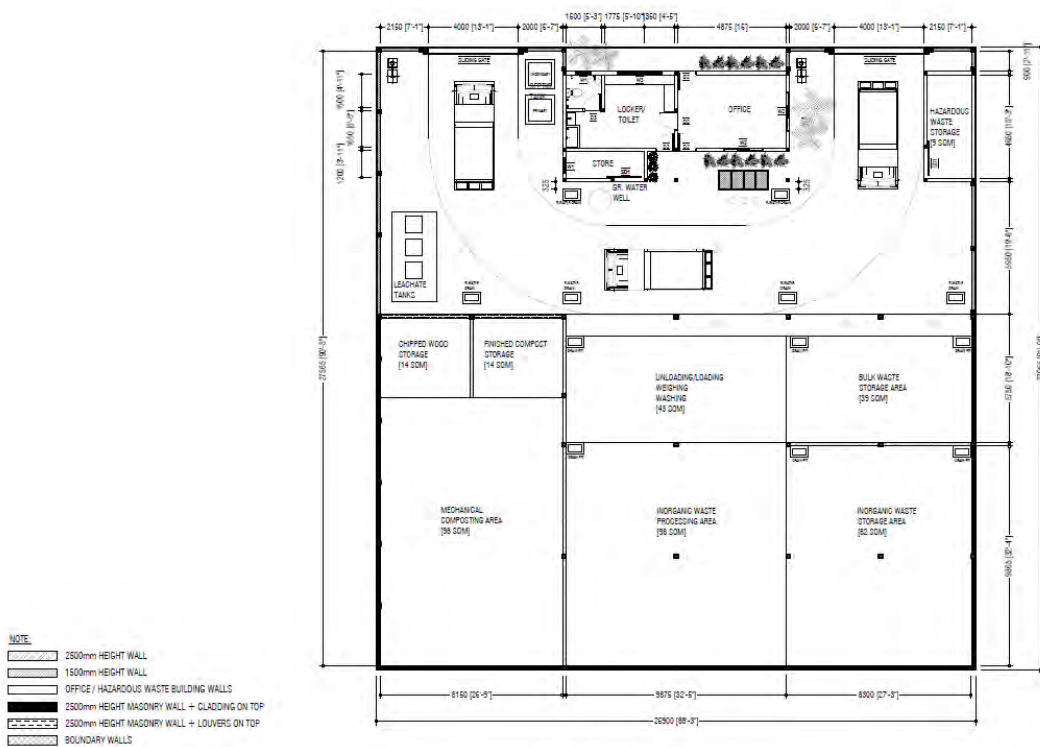


Figure 3 Proposed Layout of the IWRMC

2.5.1 Construction Phase

Construction phase of the proposed IWRMC includes the following:

a) Machinery

The following plants and equipment will be mobilized specifically for the project during construction phase.

- Vibratory plate compactor;
- Concrete mixer;
- Concrete supply pump and piping; and
- Daily 4” pump.

b) Mobilization

The contractor has already mobilized to the site with staff, some of the construction materials, and tools. However, civil works have been put on hold until ESMP can be updated and cleared. Due to this, the work force has temporarily demobilized from the site until further notice. A storeroom (**Figure 4**) was arranged through Madifushi Council to safely store the cement and sand brought by the contractor for a period of 1-month.



Figure 4 Material Storage Room

Any additional construction materials brought during remobilisation shall be kept inside the demarcated site. The workers if sourced from outside the island can be accommodated in the existing houses with a small rent. This is expected to eliminate the need for putting up a labour quarter and can be cost effective.

c) Demarcation

The site was surveyed by the proponent's team on 22 May 2023, and initial site demarcation (using pegs and ropes) was done together with the Island Council as per the Zonal approval issued by MNPHI and the dimensions of the detailed engineering drawing. Geographic coordinates of 4 corners of the IWRMC site was taken for future reference. The site shall be properly demarcated through hoarding prior to work commencement and work shall be conducted within these limits.

The site in the project island requires no removal of vegetation as this site is located in the newly reclaimed area of the island.



Figure 5 IWRMC site (grey hatched area) and area zoned for waste management in the LUP (green triangle)



Figure 6 Site surveying works

d) Foundation

The foundation for the proposed IWRMC consists concrete footing and concrete foundation beams.

Excavation: Excavation will be undertaken to the required width, depths and dimensions of footings. Excavations will be done manually to receive the ground beams.

Concreting Materials: Cement used will be Ordinary Portland Cement. All cement will be transported in watertight containers and will be protected from moisture until used. Caked or lumpy cement will not be used.

e) Construction of Slab

Reinforced concrete slabs will be cast over the ground beams. Thickness of the slabs will differ at different locations of the IWRMC. 75mm thickness will be used in the office area, 100mm in the hazardous waste storage area, bulk waste storage area and mechanical composting area, and 150mm thickness for rest of the waste processing areas.

f) Construction of Parameter Wall

A parameter wall will be constructed surrounding the IWRMC except the gate area. The parameter wall will have a height of 2500mm (2.5m).

g) Construction of Superstructure

The superstructure of the IWRMC consists of the following:

- Waste unloading and loading area for weighing and sorting of incoming waste to organic and inorganic fractions.
- Mechanical composting area where in-vessel composting will be carried out.
- Area for storage of finished compost and chipped wood.
- Inorganic waste processing area where waste will be further segregated into plastic, metal, glass etc. and processed via baling, compaction or crushing.
- Inorganic waste storage area where the processed waste will be stored. The design considers storage of such waste for 4 – 6 months, which will then have to be transferred to the subject RWMF.
- Bulk waste storage area to store bulk waste such as old furniture, roofing sheets etc.
- Hazardous waste storage area

The superstructure of the IWRMC are roofed areas with concrete slab and brick walls. The height of the boundary wall will be 5900mm (5.9m), while the hazardous waste storage area will be 3500mm (3.5m) high.

h) Construction of Office, Toilet and Locker

An office and a toilet will be constructed towards the main entrance of the IWRMC. A 12000 BTU air-condition, lights, ceiling fans and sockets will be installed at the office. The toilet will have adequate ventilation. A wash area and a locker will adjoin the toilet. The structure will consist of 3500mm (3.5m) high walls.

i) Construction of Leachate Tank

The leachate collection tanks will be constructed close to the mechanical composting area as shown in the drawing. Excavation required for the construction of these tanks can be done manually and the excavated material is recommended to be stored on the side of plot. The drain at the mechanical composting area will be connected to these tanks.

j) Construction of Septic Tank

Construction of a septic tank is proposed to manage the sewage generated during the operational phase since a sewer connection point do not exist close to the proposed site. The tank will be constructed to ensure water tightness. Waterproof paint will be used on the masonry wall.

The septic tank consists of a primary tank of 1.3 m by 1.3 m made of 150 mm brick wall, covered with 75 mm thick concrete with 6 mm reinforcing steel placed at 150 mm centre to centre. The primary tank is 2 m deep. The primary tank is connected by a 100 mm diameter PVC pipe to a secondary tank of the same dimensions filled with 1 m of coral stone and white sand filling. The bottom 1 m of this secondary tank is perforated with 25 mm equally distributed holes to allow for discharge of treated effluent. Provision will be made for future connection to the island sewer network.

k) Installation of Drains

Several rainwater drains will be constructed at the open areas of the IWRMC as shown in the drawing. These drains will be connected to the septic tank. In addition to these, drains will also be installed at the mechanical composting and inorganic waste processing areas for dealing with wastewater produced during washing of floors. The drain at the mechanical composting area will be connected to the adjacent leachate well, while the drain at the inorganic waste processing area will be connected to the septic tank. The drain at the toilet will also be connected to the septic tank.

l) Construction of Groundwater Well

A groundwater well be constructed for non-portable use with water pump installed to connect water to the different parts of the IWRMC. Water will be connected to the toilet and wash area. Water taps will be installed at waste sorting (loading / unloading / weighing), mechanical composting and inorganic waste processing areas for washing the floors.

Excavations will be done to a depth depending on the depth of the water table. After the excavation, the well base and body is fitted into the pit, and the top cover is laid on top of it.

m) Connecting Electricity

3 phase electricity required for the operations of the IWRMC will be sourced from the island power house. A 4-core power cable will be laid from the nearest distribution box. The nearest permanent distribution box is located 175m north of the site. However, a temporary distribution box exists 97m west of the site, at a close proximity to the new powerhouse, which, according to Madifushi Council, is planned to be made permanent very soon.

n) Plumbing Works

Internal water piping will be laid to connect water to the different parts of the IWRMC. A water pump will be installed to connect water to the toilet, wash area, waste sorting / processing areas and the mechanical composting area from the groundwater well.

o) Installation of Firefighting Equipment

The contractor will supply and install the following firefighting equipment as part of the contract.

- 50KG DCP Trolley for collection bay (nos 2)
- 50LTR Foam Trolley for collection bay (nos 1)
- Wet Chemical 6Ltr with Cabinet for hazardous waste area (nos 1)
- Water 9Ltr with Cabinet for Office Area – Outside (nos 1)
- CO2 2KG with Cabinet for Office Area – Outside (nos 1)

p) Inspection of concrete works

Inspection of foundation, formwork and reinforcement will be made by the Proponent before concrete pouring is commenced.

q) Labour Requirements and Availability

A 10-person workforce would be involved in the construction. It is encouraged to choose workers from within the island, to reduce the impacts of influx of non-local workers. If no such arrangements are made, labour accommodation will be arranged for the 10-person workforce from existing houses.

r) Waste Management

Construction waste, which would mainly be excavated earth, nylon cement bags and general construction debris shall be collected and temporarily stockpiled in the project site. The small amounts of waste oil that may be generated from vehicles shall be contained in closed containers and shall not be allowed to leak into the ground.

A description of how various types of wastes generated from the project will be managed is given below.

- *Biodegradable waste*

Wastes such as leaves, branches, paper, and materials collected from the general cleaning of the site areas will be stored at an area adjacent to site within Zone 54.2 of the LUP allocated for waste management (refer to **Figure 5**).

- *Non-biodegradable waste*

Materials such as plastics and glass will have to be collected separately and transported to nearest waste management facility at the end of the project construction period. These will most likely be nylon cement bags, wrappings, steel/glass leftovers and other municipal waste generated at the construction site.

- *Kitchen waste*

Food wastes and other biodegradable wastes generated in food preparation shall disposed through the existing arrangements at the island.

- *Hazardous waste*

During construction phase, hazardous waste generated from machineries such as oils, solvents, batteries etc. shall be sealed in labelled containers and shall be stored on paved hard surface before being transported to the nearest regional waste management facility. The contractor shall develop a 10 by 20m temporary area waste adjacent to the IWRMC to store hazardous within Zone 54.2 of the LUP allocated for waste management (refer to **Figure 5**). It is essential to ensure that hazardous waste is fully contained and transported out of the island to nearest regional waste manage facility as quickly as possible. It is recommended to install signs in the designated temporary storage area.

s) Pollution and Control Measures

The following measures will be taken to control pollution during construction stage.

- Machinery to be properly tuned and maintained to reduce emissions/spills/leaks;
- fuel storage, paint, lubricants will be stored securely and bunded;
- spill kits would be made available on site to control any liquid spills;
- construction site will be wetted regularly to minimize impacts of dust; and
- all vehicles used for the project must have up to date road worthiness license.

t) Health and Safety Measures

The project involves many activities that can put workers as well as the general public to risk of injuries and accidents. However, with careful precautionary measures and good practices during the works can eliminate or reduce many of these risks. Health and safety measures for the construction phase include and are not limited to:

- Undertaking all relevant safety measure during construction works shall be part of the legal contract to undertake the works. The contractor shall be made to bear the responsibility to protect the workers as well as the general public from activities related to the project.;
- Strict supervisor shall take place during construction and decommissioning phase of the project;
- Only experienced and licensed operators will be allowed to operate heavy machines;

- First aid kit should be made available at the work site;
- PPE should be provided to all workers and the work force would be required to use safety gears as appropriate;
- Fire extinguishing equipment would be available at the site;
- Operation of any heavy machinery will need the assistance of a banksman as all times;
- All heavy lifts must be supervised and slings inspected; and
- Appropriate safety signs shall be placed at the work site.

u) Demobilization

The demobilization plan will commence in the last week of the contract. This would involve removing all items and personnel belonging to the contractor and handing over of the site to ME. Prior to demobilization and site handover site inspection by the officials of the ME will take place to ensure that project has been completed to the full satisfaction of ME and scope of work fully completed. The demobilization shall also involve removal of all residual waste generated from the project and repairing of any public property damaged during the project. These will be the responsibility of the contractor.

2.5.2. Operational phase

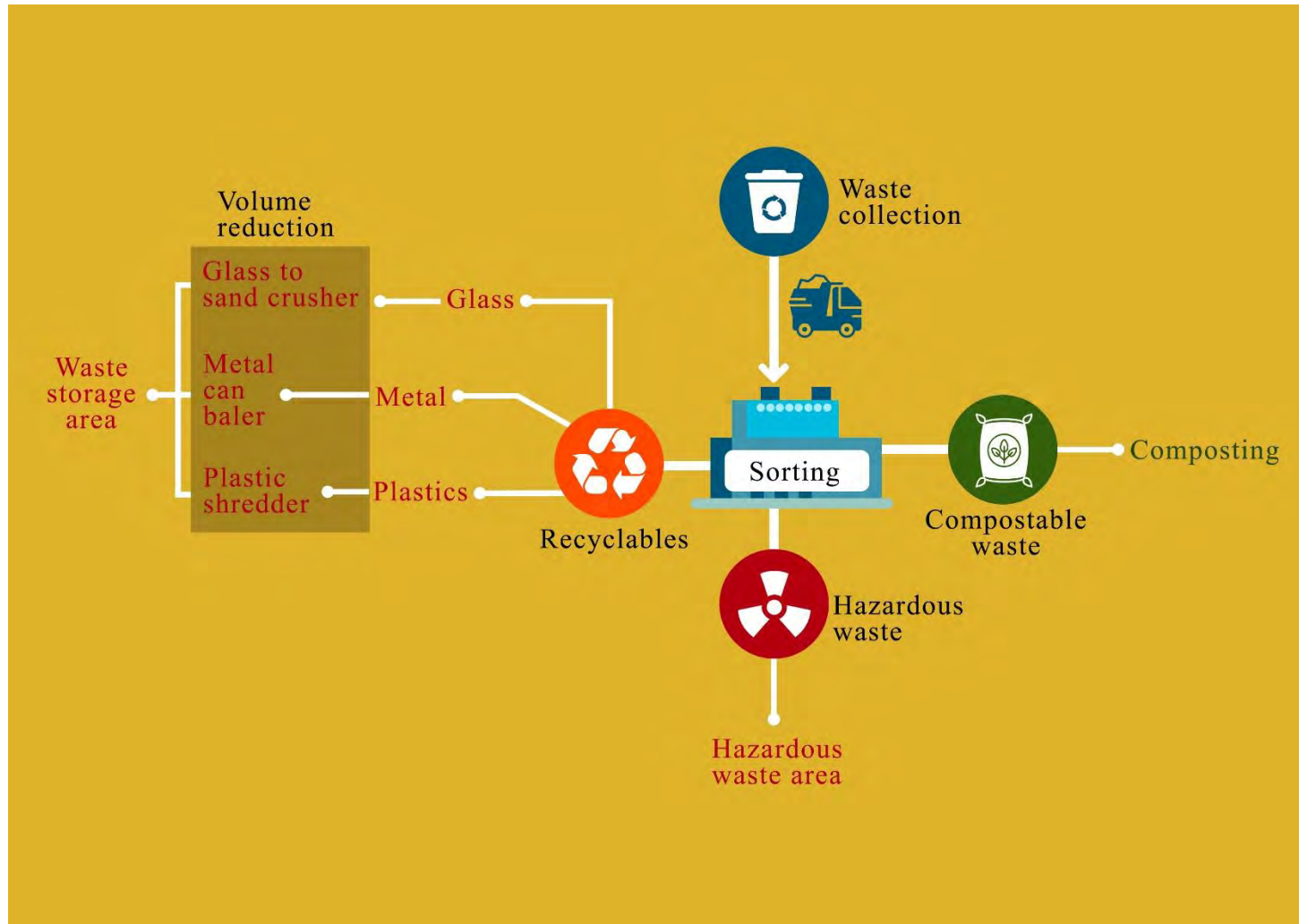


Figure 7 Operational Phase Flow Chart

The following section will briefly highlight the operational aspects of the IWRMC. This includes the machinery and equipment proposed to be used in the IWRMC, in addition to the main activities to be carried out at the IWRMC and within the island. The IWRMC activities begin from collecting waste generated at source and transporting it to the IWRMC. This collected waste will be pre-sorted into categories such as compostable waste, recyclable waste, bulky waste and hazardous waste. Compostable waste is used in making compost while glass, plastics and metals undergo volume reduction processes before being stored in their respective compartments. The hazardous waste is stored in the hazardous waste store.

a) Machinery and equipment proposed

The main machinery proposed to be used in the operations of the IWRMC is the in-vessel composting machine that will be used to treat organic waste. In addition to this, the IWRMC will require general tools to handle the waste. These include wheelbarrows, garden hose, shovels, buckets and cultivators. These tools are envisaged to be used during operations for handling as well as composting operations

A glass crusher, multipurpose baler, dustbins, weighing scale, and consumables, along with critical spares for the initial year of operations will be provided through MCEP. A supplier has already been identified (selected through competitive bidding), with the equipment expected to be delivered by the time the civil works of the centre gets completed. The supplier will also provide commissioning, operations and maintenance (O&M) training and initial equipment servicing support as part of the contract.

Furthermore, the island council may utilise monthly operational support to be provided by MoECCT through the Maldives Green Fund to restock critical spares and consumables, and for other operational expenses.

Table 4 provides typical equipment and tools required to operate an IWRMC.

Table 4 Typical equipment proposed for waste management works

Waste Management Equipment
Chainsaw
Wheelbarrow
Heavy Duty Gumboots
Heavy Duty Hand Safety Gloves
Long Handled Flathead Steel Rake
Long Handled Cultivator
Garden Hoe
Round Point Shovel
Square Point Shovel
20L Bucket
40L Bucket
Polypropylene Surgical Mask
Weighing Bench Scale
Wheellie Bins
Glass to Sand Crusher

Plastic Shredder
Metal Can Baler
Wood Chipper
In-vessel composting machine

b) Waste Collection

During the consultation held with Madifushi Council during the preparation of the ESMP, it was identified that the IWRMC operational works will be carried out by the Council.

MCEP will provide a collection vehicle (2-ton pickup with tail gate lifting mechanism) to further assist the council to establish a proper door to door or kerbside waste collection system within the island. The supply of vehicle to Th. Madifushi, which is a part of a larger supply contractor, is at present in tender stage.

c) Sorting, Processing and Storage of Incoming Waste

Incoming waste is required to be sorted to separate biodegradable and non-biodegradable waste. The separation of kitchen waste, yard waste and other types of waste at household level can streamline this process.

Table 5 Domestic Waste Categories

Incoming Domestic Waste			
Biodegradable materials	Hazardous materials	Others	Recyclables
Organics <ul style="list-style-type: none"> • Food waste • Garden waste • Animal waste Paper & Cardboard <ul style="list-style-type: none"> • Printed paper • Cardboard 	<ul style="list-style-type: none"> • Paints & Solvents • Batteries • Cleaners • Expired medicine • Medical waste • Pesticides • Special (Nappies, tampons) 	<ul style="list-style-type: none"> • Textiles • Wood • Inert (Dust/Dirt/Ash/Rock) • Liquid container 	<ul style="list-style-type: none"> • Metal • Plastic • Glass

As per the IWRMC site layout plan, further segregation of the received waste will be undertaken at the 43sqm area proposed for Waste Unloading, Weighing and Washing. Here, the collected waste will be kept, further sorted into their respective categories and weighed. Inorganic waste will then be set for processing to the 98sqm Inorganic Waste Processing Area. This will be achieved via crushing of glass, shredding or plastics and baling of metal cans. The processed waste will then be stored in 82sqm Inorganic Waste Processing Area for 4 – 6 months until transfer to the subject Regional Waste Management Facility (RWMF) is achieved. Hazardous waste will be taken to the hazardous waste store and stored separately. Likewise, bulky waste such as old furniture, roofing sheets etc. will be stored in the 39sqm Bulk Waste Storage Area.

Organic waste will be sent to the proposed Mechanical Composting Area (a 98sqm area) to undergo in-vessel composting, while received wood will be chipped outside at the compound or at the mechanical composting area using a wood chipper and stored in the respective 14sqm Chipped Wood Storage. The compost produced will be stored in the 14sqm Finished Compost Storage.

d) Composting

One of the main operations that will be conducted in the IWRMC is the composting of the organic waste such as kitchen waste and green waste. Composting uses the process of the slow decomposition of the organic matter by various microorganisms, in an optimized and controlled process. The process is controlled in terms of parameters such as input materials, temperature, moisture and pH. The finished product of composting can be sold as fertilizer, thus enabling the reuse of the waste collected within the island.

The In-Vessel Composting Process:

The in-vessel composting machine will be supplied at a later stage after the completion of the civil works required for its installation and hence is considered as an associated activity of the subject project. As per the current project implementation schedule, the machine is expected to be supplied, installed and commissioned within the last quarter of 2021. The proposed technology is more advantageous and convenient than the traditional windrow-based composting, which many of the islands are struggling to effectively implement due it being highly labour intensive.

Unlike a normal windrow-based system, the technology involves initial ‘in-vessel’ processing of the waste in the “Organic Waste Converter [OWC]” machine. The bio-degradable waste is chopped to the desired size; moisture is adjusted to 40-45%, using an organic absorbent (typically sawdust or shredded leaves), if required, and treated with Bioculum OWC™ [a formulation with 5 different Bacillus species] @ 1-2gm per kg of waste. The OWC machine has a running time of 15 – 30 minutes per batch, depending on unit and batch size. The treated waste is kept for composting and curing. This system has been designed for south Asian conditions as experienced in India and the Maldives.

It is claimed “that treatment, composting and curing is achieved within a short time of 10 to 12 days. Processing of waste through the OWC machine overcomes the problems of odour, leachate generation and ground water contamination associated with traditional methods of waste disposal. It converts unsightly and odorous garbage into a beneficial material devoid of foul odours and unsightly appearance. It is an innovative method for the bio-stabilization and beneficial conversion of organic waste. The organic material produced by this method not only provides nutrients to the plants, it also improves the organic-carbon content and moisture retaining capacity of the soil.”

Advantages claimed for the OWC include:

- *Simple and convenient to operate without the need for constant attention;*
- *Short processing times ensures economic in use with low energy consumption;*
- *Requires minimal maintenance;*
- *Beneficial to the environment.*

The OWC Process:



Pic 1: Segregate the waste



Pic 2: Input wet waste into OWC with Bioculum and Absorbent



Pic 3: After 15 minutes collect raw compost from OWC



Pic 4: Place raw compost in the curing system for 10-day maturation cycle

The pictures give an overview of the CWC process. If required, as shown in **pic 1**, waste can be further sorted and segregated. The waste is then added to the OWC unit, **pic 2**, together with the Bioculum, which is a bacterial powder that enhances the natural aerobic process. The Bioculum is added at the rate of 1 gm/kg of raw waste. Also added at this stage, if required, is the absorbent at a rate of up to 2 kg per batch. The OWC unit is operated for a period of 15 – 30 minutes, depending on size of unit and batch size, during which the waste, Bioculum and absorbent are mixed to achieve a homogenous consistency. The raw compost is discharged into crates of 25kg capacity, **pic 3**. The crates are then placed in curing racks for a period of 10 to 12 days, **pic 4**. The curing racks are equipped with an automatic fogging device that maintains moisture content at the correct level thereby ensuring curing is completed.

At the end of the curing period, the crates can be emptied with the cured compost ready for use; however, after emptying the crate, leaving the cured compost for a further seven days enhances the composts maturity, providing a higher quality product. Typically, the cured compost amounts to some 25 – 35%, by weight, of the raw waste input.

It is worth noting that the amount of waste that can be processed through the OWC each day is determined by the operating hours. This provides flexibility during times of unexpectedly high inputs or following unanticipated outages. It also allows increasing throughputs to be accommodated at minimal cost. The critical sizing and potential pinch point is the curing system; however, additional racks and/or crates require only small areas of land and modest capital expenditure.

e) Sewage Management

The island sewer network is yet to be laid at the reclaimed part of the island. Therefore, a septic tank will be constructed at the IWRMC, with provision made for future connection to the island sewerage system when the sewer network reaches this area.

The 'primary tank' facilitates 'primary treatment'. The separation of liquids and solids by gravity - to take place. Raw sewage flows into the tank and the heavy solids, 'sludge', sink to the bottom, lighter solids, grease and oils or 'scum' float to the surface. Some of the sludge is degraded by naturally occurring anaerobic (without oxygen) bacteria. The liquid effluent flows to the secondary tank which is filled up to 1 m with coral stone and white sand layer. This tank is perforated at the bottom 1 m to allow for discharge of liquid effluent into the land.

The most environmentally sound method for disposing the domestic sludge is allowing it for drying in a sludge drying bed. The dry sludge can be used following appropriate treatment, as part of compost. Sludge will be dried on a sludge drying bed.

f) Waste Transport to a Regional Facility

The proposed IWRMC is planned to manage a portion of the waste produced at the island level, with the unmanaged waste (approximately 30% of waste generated within the island to be transported to a central waste management facility). The projected capacity for 1 month's waste for the island of Madifushi is shown below.

Organic wastes make up the bulk of the waste stream in Madifushi, which can be managed within the island itself via composting. The proposed technology for composting (in-vessel composting using a compost machine) ensures that organic waste generated in the island is treated and managed effectively at the shortest possible time. The inorganic waste received will be subjected to volume reduction via shredding, crushing, baling and compacting and subsequently stored in the respective areas designated for their storage within the IWRMC. The IWRMC is designed to cater for the storage of such wastes for up to 4 – 6 months, which would then need to be transported to a RWMF for further treatment and disposal. Hence it is imperative that waste from the island is routinely transported to a RWMF quarterly or bi-annually.

The subject RWMF for Zone 4&5 is the Zone 3 RWMF (Thilafushi), which is currently in the process of being developed into a contemporary facility via the Greater Male' Environmental Improvement and Waste Management Project funded by the ADB. This regional facility will primarily use 2 waste to energy (WtE) plants of 250 tons per day capacity and ancillary facilities for treating the residual waste coming from the islands. The project is expected to be completed and the regional facility made fully operational by mid-2025. Since the IWRMC will be made operational prior to this, intermediary transfer of residual waste to Thilafushi will be required to be facilitated by the GoM.

2.6. Project Inputs and Outputs

The table below elaborates the approximate amount of resources that will be required for the project. These include workers, fuel, water, and construction materials.

Table 6 Project Inputs

	Input Resource	Type and Amount	Means of obtaining the resource
CONSTRUCTION PHASE	Workers	10	Around 10 workers. Contractor is encouraged to use local or regional workers as much as possible. If expatriate workers are used, they must carry valid work permits. Construction workers are expected to be accommodated in local houses and / or guesthouses. No temporary site setup is required for this project. Contractor will make arrangements with the local council regarding accommodation arrangements.
	Site Supervisor	1	The site supervisor should ideally be local as he/she should be able to regularly communicate with the island council and the community over matters related to the project. It is important for the supervisor to have a fairly good understanding of social and cultural norms of the society.
	Site Engineer	1	The site engineer shall not necessarily be based in the project island but should visit frequently during construction.
	Water for Construction	150 litres per day	Groundwater well dug at the IWRMC.
	Construction Materials	Concrete, cement, flood lights, G.I. pipes, metal sliding doors, emulsion paint, Lysaght Roofing Sheet, 3 phase power sockets, ceiling fan and Timber	Imported or purchased where available locally. Contractor will make arrangements to import or purchase these materials and transport to the island.
	Construction Machinery	Pickups, trucks or wheelbarrows (for land transport of construction material), transfer vessel, cement mixing machine.	Responsibility of the contractor. Local resources such as pickups for hire will be utilized as much as possible. If not available locally the contractor will import these machineries.
	Fuel	Diesel	Local suppliers
	Portable Fire Extinguisher	1 Extinguisher	Responsibility of the contractor. Imported or purchased locally and to be brought to the site during mobilization.
OPERATIONAL PHASE	Equipment	<ul style="list-style-type: none"> • 1 In-vessel composting machine • 1 Glass crusher • 1 multipurpose baler • 1 Wood Chipper • 1 Waste Collection Vehicle with lifting mechanism 	Responsibility of the Proponent (Capital Investment) and Island Council (O&M). Purchased locally or imported.

Firefighting Equipment	<ul style="list-style-type: none"> • 50KG DCP Trolley for collection bay (nos 2) • 50LTR Foam Trolley for collection bay (nos 1) • Wet Chemical 6Ltr with Cabinet for hazardous waste area (nos 1) • Water 9Ltr with Cabinet for Office Area – Outside (nos 1) • CO2 2KG with Cabinet for Office Area – Outside (nos 1) 	Responsibility of the Proponent (Capital Investment) and Island Council (O&M). Purchased locally or imported.
Water for non-portal use	Groundwater	Groundwater well within the IWRMC
Power	3-phase power for operation of waste management equipment.	From the existing 25sqmm 4 core power supply cable laid from the nearest distribution box to the waste yard distribution board.
Labour	About 3 workers to manage waste in the IWRMC and 3 workers to provide collection services to the community.	Responsibility of the Island Council. From the local community or expatriate workers. Island council or the outsourced third party will make accommodation arrangements within local houses and guesthouses if expatriate workers are recruited.
Fuel	Diesel	Local suppliers.
Waste	Waste generated within the island. Approximately 915.9 kg of waste per day.	Waste will be collected from households and businesses within the island.

Table 7 Project Outputs

	Output Resource	Type and Amount	Means of managing
CONSTRUCTIONPHASE	General Construction and Demolition Waste	Moderate amount of Solid Waste	Construction and demolition waste generated will be reused as much as possible. Any remaining waste will be transferred to the nearest regional facility by the contractor.
	Municipal Waste	Small quantity	Removed to the disposal site designated by the council.
	Soil	Excavation for substructure	To be used as backfilling during construction.
	Dust	Moderate amount during cement mixing and excavation	Wet the construction site regularly.
	Waste oil and diesel	Small quantity	Barrelled and kept at the temporary waste storage area and transfer to the nearest regional waste management facility for disposal during demobilisation.
	Greenhouse Gas Emissions	Small quantity. Emissions from construction	All vehicles and machinery must be well tuned.

		material transporting vehicles and construction machinery.	
OPERATIONAL PHASE	Compost	In-vessel composting.	Used locally for agricultural purposes or sold to nearby resorts.
	Inorganic Waste	Crushed glass, compacted metal, baled plastic.	Reused within the community as much as possible. Remaining waste stored in their respective area within the IWRMC and transferred to the subject RWMF quarterly or bi-annually
	Greenhouse Gas Emissions	Electricity usage. Minute quantity.	N/A

CHAPTER 3 EXISTING ENVIRONMENT

3.1. Description of the Environment

Th. Madifushi has a natural land area of 20 ha. An additional 29.32 ha of land has been reclaimed. The island's community of 856 people (774 local and 82 foreign) has a settlement footprint of 15 ha. This is 75% of the natural island's total land area. Land allocated for construction of the IWRMC is located in the newly reclaimed area.



Figure 8 (A) Newly reclaimed area and coconut palms of the islands natural vegetation line (B) Boat building work (C) Area being developed as an artificial beach (D) Coastal protection of newly reclaimed area

The coastal area close to the project site has a protective revetment built during land reclamation. The revetment should provide sufficient protection. It is reported that sea swells are observed from the south east side near the plot originally allocated for the construction of RO plant building. As the land has been recently reclaimed; there is no vegetation line or a protective vegetation belt present at the site.

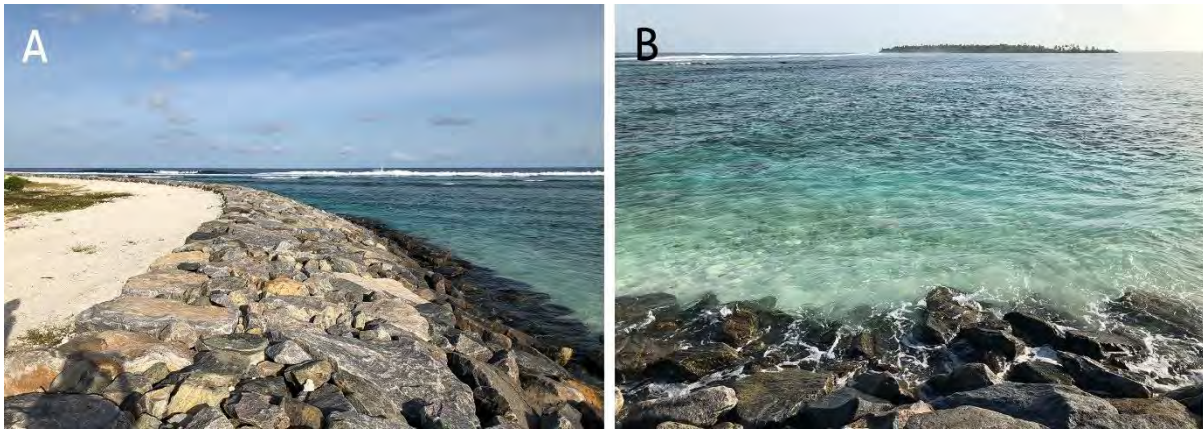


Figure 9 (A) and (B) Revetment close to the project area

3.2. Project Site

The proposed IWRMC is located at the southern side of the island. The land has been recently reclaimed. There is no vegetation at the site. The site is easily accessible. The previous MLSA approved site for developing the IWRMC was shifted towards the east with an offset of 47m, due to RO plant building location being changed to this area to mitigate for sea swells observed at the original RO plant site. Zonal approval from the MNPHI was obtained for the revised IWRMC site on 18 May 2023, which is marked as 54.2 in the draft updated LUP of Th. Madifushi. The site adheres to the requirements of Maldives Land Act and EPA's "Environmental Guideline for Site Selection of Waste Management Centres".



Figure 10 IWRMC site



Figure 11 a 21m buffer is kept between the revetment and the site

3.2.1. Site zoning guidelines by EPA & MLSA

The EPA has provided recommendations for the optimum zoning of the IWRMC site. The distances include, the site being at least 10-15 m from the revetment, at least 30 m from the nearest freshwater well, at least 40 m from the nearest recreational area. The field surveys done on the island recorded the locations of the aforementioned categories and the comparison table for the actual distances and EPA guidelines are provided below:

Table 8 Comparison between the proposed site location and EPA guideline distances

Location	Distance from site (m)	EPA Recommended Distance (m)
Revetment	21	10-15
Freshwater well	265	30
Recreational area (volley court)	335	40
Residential area	175	30

As seen on **Table 8**, the site meets all the recommendations of the EPA

3.3. Current State of Waste Generation

The rate of solid waste production depends on the socio-economic situation, the level of industrialization, type and numbers of industries, climate, and land use and therefore can vary from island to island. However, such variations are not expected to be significantly different from island to island and therefore

in making estimates waste audits conducted for similar islands can be safely applied. Hence, past waste audits had been used to estimate waste composition and quantities for Madifushi.

According to the waste audit conducted in 2016 for Zone 1 (which includes HA, HDh, and Sh.) an average per capita waste generation was found to be 1.30 kg/person/day. The study also finds that, by far the most significant proportion of the waste is green and compostable (75%), plastics comprising of 6%, paper and cardboard making 5% of the waste, 1% metals, 6% hazardous waste, 1% glass and 6% attributed to all other types of waste.

In another waste audit study conducted by the Ministry of Environment, Climate Change and Technology in 2011 under the Maldives Environmental Management Project (MEMP) for five inhabited islands in the north central region of the Maldives (Hinnavaru, Naifaruru, Eydhafushi, Maalhos, Lhohi), it was determined that 0.83 Kg of waste was generated/person/day. Similar to the above study it was revealed that organics was the largest component making 65% of the household waste stream, plastics comprising of 5%, paper and cardboard making 5% of the waste, 1% metals, 8% hazardous waste, 2% glass and 8% attributed to all other types of waste.

The estimated percentage of organic waste as well as the sum of the plastics, glass and metals for both zones were found to be very similar hence the averages of the two studies were taken and considered to be the estimated percentages of various types of waste generated in Madifushi Island as shown in **Figure 12**. Similarly, per capita waste generation for the island had been determined by taking the average per capita in the two studies above which is 1.07 Kg/person/day. This finding is expected, since the lifestyle and food habits are similar for most of the inhabited islands across Maldives with the exception of Male' and few other cities.

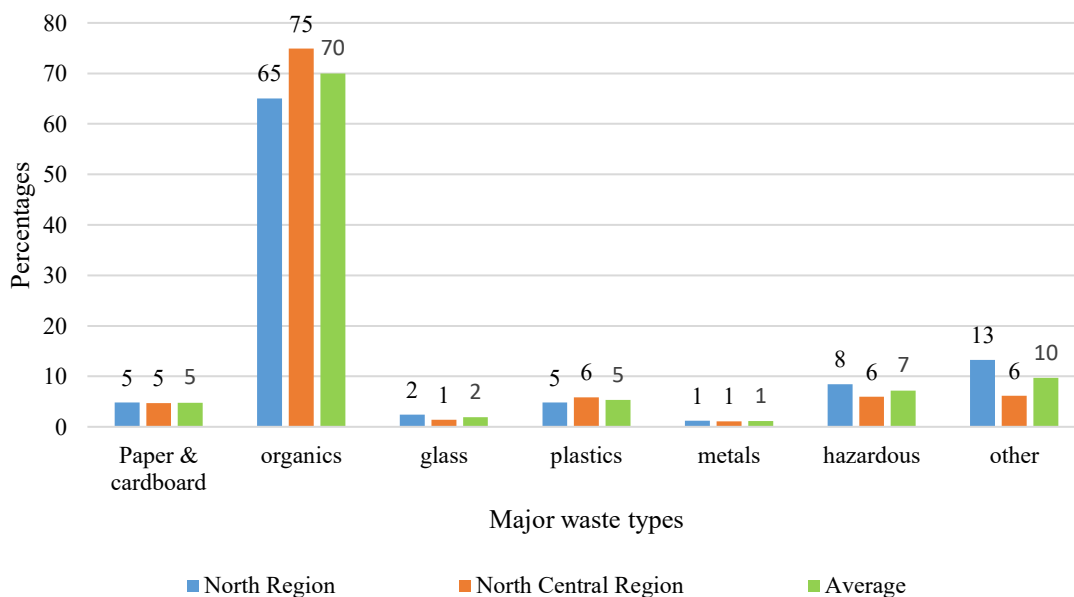


Figure 12 Waste composition comparison in two separate regions of the Maldives

Hence it is expected that the majority of the waste generated in the island to be organic wastes at 70%, which include kitchen and green wastes or compostable waste. Paper and cardboard wastes is estimated at 5% of the total waste generated. Recyclable materials such as plastic, metals, and glass make up 8% of the composition. Approximately 7% of the total waste generated is chemicals and hazardous waste and all other types are expected to be at 10%. Using these estimates and considering the current population of Th. Madifushi, the daily waste generation was determined as shown in **Table 9**.

Table 9 Estimated waste generation quantities of Th. Madifushi households

Waste Type	Average (%)	Waste Generation (Kg/Person/Day)	Total (Kg/Day)
Organic (kitchen & green waste)	70	0.75	642
Paper / cardboard	5	0.05	42.8
Glass	2	0.02	17.1
Plastic	5	0.05	42.8
Metals	1	0.01	8.6
Chemicals / Hazardous	7	0.07	59.9
Others	10	0.11	94.2
Total	100	1.07	915.9

Hence it is estimated that a total of **915.9 Kg** of solid waste will be generated daily at Madifushi.

3.4. Current state of waste management in Th. Madifushi

The majority of waste sources in Th. Madifushi is households. Boat building is one of the notable commercial activities observed in the island. As far as institutions are concerned, typical institutions that are commonly found in an average island were found. These include School, Health Centre, Secretariat of Island Council and magistrate court. Agriculture is not practiced at a large scale. The island has two cafés' currently in operation

Madifushi Council allocated a 3000 sqft area as the island's designated dumpsite (see **Figure 13**). This area is demarcated with compartments for separated metals, glass and plastics. The operation of the dumpsite as well as cleaning of the public spaces is being conducted by the Women's Development Committee (WDC). Green waste is regularly burned here. Kitchen waste is dumped into the lagoon. The island council stated that waste is separated at household level. There are three battery powered mini pickups that operate on the island to provide waste transportation service for approximately 100 – 150 MVR per month. These vehicles are operated by private parties, according to the Island Council.

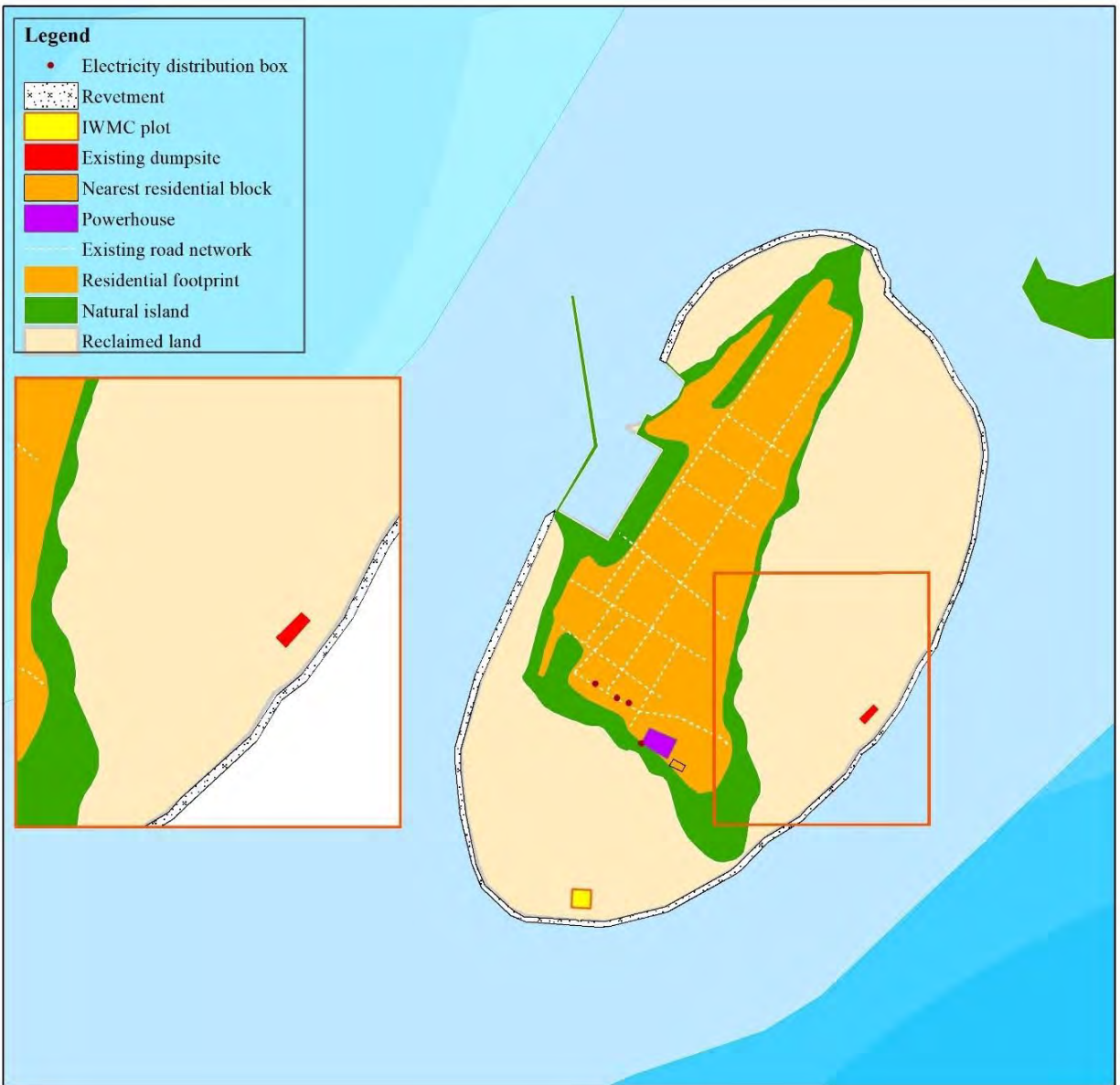


Figure 13 Areas where waste is currently disposed at Th. Madifushi

The current state of waste management on the island is summarised in **Table 10**.

Table 10 Current waste management status of the island

Parameter	Yes	No	Number	Description
Harbour (accessibility)			-	<ul style="list-style-type: none"> • Determined to be accessible. Ramp provided
Waste transportation			-	<ul style="list-style-type: none"> • Waste collection services are provided by private parties
Vehicles for waste transportation			-	<ul style="list-style-type: none"> • Three mini pickups belonging to private parties. No such vehicles belong to the Council
Waste management equipment			-	<ul style="list-style-type: none"> • No waste management equipment
Presence of dumpsites			1	<ul style="list-style-type: none"> • 1 dumpsite is present
Dump site demarcated				<ul style="list-style-type: none"> • Site is demarcated
Separation of waste at dumpsite			-	<ul style="list-style-type: none"> • Waste is separated into metal, plastic, glass, green waste
Burning waste			-	<ul style="list-style-type: none"> • Green waste is burnt regularly
Burying waste			-	<ul style="list-style-type: none"> • Waste is buried to reduce volume
Dumping waste into the beach/sea			-	<ul style="list-style-type: none"> • Kitchen waste is dumped into the lagoon
Presence of large waste piles			-	<ul style="list-style-type: none"> • Dumpsite has filled up during the two years with no means of reducing volume of transporting the waste out of the island
Pollution of inland/other areas			-	<ul style="list-style-type: none"> • Terrestrial pollution of inland areas is controlled
Clinical waste management			-	<ul style="list-style-type: none"> • Clinical waste is managed at the Health Centre
Public area waste collection			-	<ul style="list-style-type: none"> • Council contracts Women’s Committee to clean and collect waste from public areas.
Presence of waste bins			-	<ul style="list-style-type: none"> • No
Presence of workers			-	<ul style="list-style-type: none"> • Women’s committee is contracted to operate the dumpsite
Electric connection at the dumpsite			-	<ul style="list-style-type: none"> • No



Figure 14 Current state of waste disposal in the island. (A) and (B) Mixed waste outside current dumpsite (C) Metal waste accumulated at the current dumpsite (D) Construction waste accumulated.

Table 11 Type of waste separated, burnt, buried and dumped at the island (Highlighted cells show which waste type is managed in the stated way)

Types of waste separated	Types of waste burnt	Types of waste buried	Type of waste dumped into beach/sea
Plastics	Plastics	Plastics	Plastics
Metals	Metals	Metals	Metals
Construction	Construction	Construction	Construction
Yard/Organic	Yard/Organic	Yard/Organic	Yard/Organic
Kitchen	Kitchen	Kitchen	Kitchen
Hazardous	Hazardous	Hazardous	Hazardous
Diapers	Diapers	Diapers	Diapers
Paper/cardboard	Paper/cardboard	Paper/cardboard	Paper/cardboard
Partial separation of mixed Waste	Mixed Waste	Mixed Waste	Mixed Waste
All	All	All	All

3.5. Island Waste Management Plan

According to the Waste Management Act of the Maldives, Island Councils are required to formulate Island Waste Management Plans (IWMP) in coordination with the Atoll Councils and get subsequent approval from EPA. Th. Madifushi has a draft IWMP which has not been approved by the EPA at the time of report preparation. According to EPA the latest revision was submitted by the Island Council on September 2020, but it was not approved since minor revisions are still required. EPA has sent request to the Island Council to revise and update the IWMP on October 2020, but is yet to receive a response to their enquiry. The IWMP sets objectives, goals, user fees and activities on waste management for the next 5 years.

During the initial consultation with the Island Council, it was stated that the Council plans to conduct the operational activities of the IWRMC themselves by hiring staff for waste collection and IWRMC management. A fee of 150 MVR per household is planned to be taken monthly to conduct the operation sustainably.

Goals and Objectives

The overarching objective of the IWMP is to sustainably manage waste in Th. Madifushi in an environmentally friendly manner and thereby resolve the difficulties faced by the community including public health concerns.

Specific objectives of the plan are:

1. Formulate and enforce comprehensive regulations and principles on waste management;
2. Inform the community and increase public awareness on the advantages and benefits of keeping the island clean;
3. Make a community transition towards waste reduction and recycling practices;
4. Procure waste management equipment and provide the required trainings;
5. Establish systematic mechanisms to collect waste from households and other places, and bring to the IWRMC;
6. Proper segregation, storage and management of waste in the IWRMC;
7. Manage waste in a financially sustainable model by taking user fees from households and other places;
8. Maintain cleanliness of public places; and
9. Formulate and enforce island level regulations to manage priority waste.

Activities and Programs

The following programs and activities are planned to achieve the objectives of the plan

Object 1: *Formulate and enforce comprehensive regulations and principles on waste management*

- Formulate island waste management committee;
- Develop an island level waste management regulation and publish it in gazette; and

- Make the public aware of the regulation and properly enforce it.

Objective 2: *Inform the community and increase public awareness on the advantages and benefits of keeping the island clean*

- General public awareness programs; and
- Awareness programs targeted for school children.

Objective 3: *Make a community transition towards waste reduction and recycling practices*

- Conduct a campaign to encourage reduction in single use plastic usage;
- Provide information to school children on how certain waste materials can be used to prepare recyclable items; and
- Exhibition for school children to showcase and display recycling practices.

Objective 4: *Procure waste management equipment and provide the required trainings;*

- Procure equipment needed for IWRMC operations;
- Establish mechanisms to install the procured equipment at the IWRMC; and
- Train staff on O&M of the equipment.

Objective 5: *Establish systematic mechanisms to collect waste from households and other places, and bring to the IWRMC*

- Collect waste from households at a designated time each day.

Objective 6: *Proper segregation, storage and management of waste in the IWRMC*

- Segregate waste into 5 parts at household level and during collection;
- Prepare compost using biodegradable waste;
- Resale of reusable items such as metals;
- Compact inorganic waste that cannot be reused and transfer to a RWMF; and
- Place dustbins in public places such as parks and harbor area.

Objective 7: *Proper segregation, storage and management of waste in the IWRMC*

- Formulate the monthly fee structure for waste collection and management;
- Consult the public regarding the proposed fee structure; and
- Finalize and implement the fee structure.

Objective 8: *Maintain cleanliness of public places*

- Place dustbins in public areas.

Objective 9: *Formulate and enforce island level regulations to manage priority waste.*

- Introduce provisions to implement extended producer responsibility (EPR) in the land agreements leased to private parties for industrial purpose;
- Establish island level guidelines or procedures in line with health policies to deal with healthcare waste;

- Facilitate storage of hazardous and priority waste at the IWRMC and organize its subsequent transfer to a RWMF; and
- Hazardous waste and priority waste to collected, handled and stored according to the WMR, where lidded contactors with warning signs shall be used for its transport.

User Fees

The IWMP states the following monthly user fees for providing Waste Management Services and corresponding revenue expected to be generated from it.

Table 12 WM user fees and expected income

#		Fee (MVR)	Quantity	Total (MVR)
1	Households	100.00	182	18200.00
2	Small Businesses	130.00	14	1820.00
3	Restaurants and Cafes	150.00	3	450.00
4	Carpentries	120.00	2	240.00
5	Workshops / Vehicle Repair Garages	130.00	0	0
6	Government Offices	150.00	11	1650.00
7	Boatbuilding huts	150.00	3	450.00
8	Large Businesses	130.00	2	260.00
	TOTAL			23070.00

Stakeholder Consultation

The IWMP was prepared in consultation with relevant stakeholders. Details of this consultation is provided in **Chapter 6** (Stakeholder Consultations) including the list of stakeholders met and the main outcomes of the discussions held.

3.6. Unassigned Waste Dumping

The roads of the island generally appeared clean. Unassigned waste dumping was not observed during the site visit.

3.7. Vegetation Removal

The proposed project does not involve removal of any vegetation as the site is located in a newly reclaimed area, devoid of any significant vegetation.

3.8. Environmentally Protected Areas and Sensitive Areas

Environmentally protected or sensitive areas are not present in Madifushi, while no sensitive areas exist at a 10km radius from the island.

The nearest sensitive areas to the Madifushi are Kanimeedhoo beach and Veymandoo mangrove area both located at a distance of approximately 34km from the island, at the southern parts of the atoll, while the island maintains distances of 41km and 43km to the sensitive areas located west of Thaa atoll, namely Fondhoo and Kafidhoo respectively. The proposed project is not envisaged to bring any negative impacts to these sites due to the long distances coupled with being separated by sea.

Table 13 Environmentally sensitive areas in Thaa Atoll

#	Sensitive Area	Description	Distance from Madifushi (km)
1	Kanimeedhoo Beach	Nesting place for turtles and the reef around the island is habitat for turtles	34
2	Veymandoo Mangrove Area	Mangrove area	34
3	Fondhoo	Nesting place for sea birds Kirudhooni and valla. Representative marine environment.	41
4	Kafidhoo	Nesting place for sea birds Kirudhooni and valla	43

3.9. Areas of Historic and Cultural Significance

There are 2 mosques and 1 cemetery on the island. However, there are no mosques of cultural significance. The project site maintains a sufficient distance from both the cemetery and the mosques. The cemetery is located behind the powerhouse, approximately 230m from the project site.

3.10. Socio-Economic Environment

3.10.1. Population

The total population of Madifushi as per census 2022 is 856 corresponding to 774 locals and 82 foreigners. (National Bureau of Statistic [NBS], 2022). The table below depicts comparison of total population with 2014 census.

Table 14 Average Annual Growth Rate, Th. Madifushi

	Census 2014	Census 2022	Percentage change in population (2006 – 2014)
Total	801	856	6.4%

According to the census, from 2014 to 2022, the total population of Madifushi had increased by 6.4%.

Households

There are 193 households in Madifushi representing houses, flats and apartments.

3.10.2. Education and Literacy Level

Primary and secondary education is provided at Madifushi School which conducts classes from grade 1 to 10. At present there are 204 students enrolled in the school; 104 females and 100 males.

According to Census 2014, 97.7% of the resident population in Madifushi is literate in mother tongue and 68.6% literate in English language. Literacy in both languages were determined by the person's ability to read and write, with understanding of the language (NBS, 2014).

3.10.3. Health

Medical services at the island is provided at the health centre. The health centre functions under a doctor, 3 nurses, laboratory technicians and administrative staff.

3.10.4. Employment, Economic Activities and Business Establishments

Similar to other inhabited islands of similar nature, 57.1% of the population of *Madifushi* above the age of 15 is economically active with 90.2% being employed and 9.8% unemployed (NBS, 2014).

Majority of the people in Madifushi are employed in fishing and ferry operations, while the women mostly practice weaving using coconut palm leaves. Boat building is also practiced to some extent with 3 huts currently in operations.

3.10.5. Non-Governmental Organizations

There are 3 registered NGOs in the island. Names of the NGOs, their current status and associated activities or main area of focus is reflected in the **Table 15** below.

Table 15 NGOs in Madifushi

#	Name of NGO	Status	Focus Area
1	Madifushi Zuvaanunge Jameeyaa	Active	Youth empowerment and sports
2	Al Kifaah	Active	Religious awareness
3	Real Madifushi	Inactive	N/A

3.10.6. Council Secretariat

Th. Madifushi Council consists of 5 members with 2 seats allocated specific for women representatives. The council took oath on 17 May 2021 and constitutes of the following members.

Table 16 Th. Madifushi Council

#	Constituency Name	Name	Mobile No	Member Type
1	Th. Madifushee Council's President	Ahmed Naseeth	9992230	President
2	Th. Madifushee Council's reserved 2 seats for female	Hawwa Nazula	7446329	Vice President
3	Th. Madifushee Council's reserved 2 seats for female	Aishath Naseera	7646053 /7867485	Member
4	Th. Madifushee Council's Member	Ali Rasheed	9167303	Member
5	Th. Madifushee Council's Member	Athif Ahmed	9567899	Member

The President and Vice President of the island council are elected by a secret ballot held among the elected members of the island council. If a member's post is vacated before the end of the tenure, another member shall be elected within 45 days through a bi-election. The elected member in a bi-election will remain in the post till the end of the term of that council.

The President and Vice-President of the Councils are responsible for day to day operational management of the Council. The responsibility of Council members includes attending official meetings of the Council, discussion and reaching resolutions on the agenda items for the meetings, and participation in the making of policies needed to achieve the objectives of the Council.

Specific duties of the Council President are as follows:

- (a) Conduct council meetings and preside over these meetings;
- (b) Administer and direct the council towards achieving its objectives;
- (c) Publish and implement the decisions of the council through the Council's Administrative Office;
- (d) Oversee the compilation of the council reports and ensure that the reports are submitted on time to the relevant authorities;
- (e) Foster and maintain good relations and cooperation between the council and Government authorities, associations and groups;
- (f) Monitor to see if the council's finances are managed by the Council's Administrative Office, according to the decisions made by the council;
- (g) Facilitate a mechanism to keep records of the Council's revenue and expenditures;
- (h) Perform other work assigned by the atoll council and the island council.

Specific duties of the Council Vice President are as follows:

- (a) Assist the President of the council in performing council's work;

(b) Perform the duties of the President of the island council, during such times as when the President of the island council is incapacitated or is excused or if the post is vacant. In addition to this, undertake responsibilities assigned by the president of the council;

(c) Perform other work assigned by the island council.

Specific duties of the Island Council Members are as follows:

(a) Work towards achieving the objectives of the island council.

(b) Carryout any work assigned by the council as per the procedures of the island council.

The island council is responsible for providing the following municipal services to the people of the island:

(a) Build and maintain roads of the island;

(b) Dispose waste in a reasonably safe manner at the island level as it does not create any inconvenience to the community;

(c) Maintain the jetty of the island, build and maintain wharf, and operate the ferry terminal of the island;

(d) In accordance with the Law of the Maldives, take necessary measures to alleviate the land erosion problem and maintain the jetty and the breakwater of the island;

(e) In accordance with the law of the Maldives, provide and maintain public facilities such as water, electricity, and sewage system;

(f) In accordance with the Law of the Maldives, provide primary health care and other basic health security services;

(g) In accordance with the Law of the Maldives, provide preschool education and organize and conduct educational and vocational programs to train adults;

(h) Administer the island library, archive official documents, preserve old and historical documents of the island in the library and with the help of modern facilities, provide access to information;

(i) Maintain social centres, play grounds or sports fields and provide sporting facilities, public parks and entertainment services;

(j) In accordance with the Law of the Maldives, run a centre to provide social security services, take measures to stop domestic violence and provide the victims of such violence with security and assistance and put in place a system to help senior citizens and people with special needs;

(k) In accordance with the Land Law of the Maldives and in a manner which does not contravene the island's Land Use Plan, allocate land and register land and buildings, and monitor if all building work undertaken is in accordance with the building regulations of the Maldives and other regulations by relevant Government ministries, and in accordance with the Land Laws and other such Laws of the Maldives, keep record of all dealings undertaken by parties in regards to matters of land;

(l) Maintain a land registry of the island and provide information required for the national land registration authority;

- (m) Maintain mosques;
- (n) Maintain cemeteries, establish burial service mechanism and organize for burial services;
- (o) Maintain historical places and promote and revive culture;
- (p) Commemorate religious and national days of importance and hold religious and national functions;
- (q) Organise to sweep and clean the roads, maintain cleanliness of the island and its beauty;
- (r) Provide the island with adequate lighting at night;
- (s) Pest controlling;
- (t) Establish a mechanism that provides assistance in an event of emergency;
- (u) Monitor and check if shops, tea boutiques, restaurants, café's, guest houses and public markets comply with standards, rules and regulations set by the law of the Maldives and take corrective measures;
- (v) Organize and manage for pedestrians, motor vehicles and non-motor vehicles to use the roads as according to the standards set by the statutes of the Maldives, and organize and manage public land and sea transport services which levy a fee to operate in compliance with the standards set by the relevant Government authority;
- (w) Assist the Courts of Law and Government authorities to execute the sentences passed by the Courts of Law.
- (x) Issuing and cancellation of permits and registries; that Government ministries provide through the island councils, and on matters that fall within the jurisdiction of the island council, and on matters that have been assigned to the island council under various laws;
- (y) Manage the birth and death registry of the island, and gather and maintain the statistical records of the island, maintain a registry of citizen and noncitizen of the island, and maintain a registry of foreigners living on the island;
- (z) Provide other services that are prescribed by Laws.

3.10.7. Electricity

Electricity is provided by FENAKA Corporation 24 hours a day. The existing power house is located centre of the island at a close proximity to the cemetery. The distance between the IWRMC site and the power house is approximately 200m. The powerhouse is in the process of being relocated to the utility area with civil works of the powerhouse building being at the verge of completion.

FENAKA uses diesel generators to provide electricity to the island community.

3.10.8. Sewerage

The island has an established sewer network which is managed by the utility company FENAKA. It is a conventional gravity collection system with two pump stations, one of which is an outfall pump station. The connection chamber of each of the registered household is connected to this network. The sewerage is discharged from the main pumping station to the sea through a sea outfall laid using anchor blocks.

Sewer network is yet to be laid to the reclaimed part of the island.

3.10.9. Water Supply

Rainwater is the primary source of freshwater in Madifushi. However, a water supply project is currently on-going in Madifushi.

The proposed water supply system will primarily include the following:

- Reverse Osmosis Plants;
- Rainwater Collection System;
- Rainwater Treatment;
- Storage Tanks; and
- Distribution Network.

The project is expected to be completed and commissioned by September 2023.

CHAPTER 4 ASSESSING THE LIKELY IMPACTS AND MITIGATION MEASURES

This chapter describes the key adverse and beneficial impacts envisaged for both construction and operational phase of the project and the methodology used for impact prediction.

4.1. Identifying Impacts and Analysis

As this is an update of a previous ESMP, the impact identification methodology is adopted from the previous ESMPs (ESMP 2018 and ESMP 2021). All impacts and mitigation measures will remain similar to the ESMP 2021 as the relocated site is similar to the original site, both located at the reclaimed part of the island, devoid of any significant vegetation (expect some grass), coupled with no changes being brought to the design and dimensions of the IWRMC. The impact identification methodology is described below.

Impact definition used in the report has been adapted from the United Nations Environment Program (UNEP, 2002). Accordingly, an impact or effect used in the current assessment implies the change in an environmental parameter, which results from a particular activity or intervention relating to the proposed Project. Thus, the change or the impact is the difference between the environmental parameter with the Project compared without the Project (baseline) measured over a specified period and within the Project location (UNEP, 2002). In identifying and predicting impacts ‘best estimates’, past experiences, professional judgments, references, and information collected from stakeholder discussions were the main methods used.

As explained, understanding the baseline condition of the Project environment and determining the extent of an impact were critical initial steps in impacts. The overall methodology applied in studying the baseline conditions included collecting information from the field and review of available relevant literature including reports, other related studies and data source. In addition, information obtained from discussions with the stakeholders was also used to characterize specific aspects of the study area. Spatial extent of the affected area/study area was determined by relevant guidance obtained during the scoping meeting, discussions with the stakeholders and professional judgment of the consultant’s team.

A modified Leopold matrix was applied in evaluating the impacts identified. The Leopold matrix, which is widely applicable in carrying out an EIA for different types of projects has been chosen as a suitable method for predicting impacts of the proposed project. A clear advantage of using the matrix ‘as a checklist or reminder’ of the large scope of actions and impacts on the environment that can relate to the proposed actions (Leopold et al., 1971). According to the Leopold matrix method, EIA should consist of three basic elements: a) a listing of the effects on the environment that the proposed development may induce, including the estimate of the magnitude of each of the effects; b) an evaluation of the importance

of each of listed effects (e.g., regional vs. local); and c) a summary evaluation, which is a combination of magnitude and importance estimates.

In order to achieve higher efficiency of the matrix, a starting point is to check each significant action listed in a horizontal axis. The experience often proves that 'only about a dozen actions will be important' (Leopold et al; 1971). Each checked action is evaluated in terms of magnitude of effect on environmental factors that are listed in the vertical axis. In the matrix, across each box where significant interaction is expected, a slash (/) is placed diagonally from upper right to lower left angle of the block. In the text which accompanies the Leopold matrix, the evaluator has to indicate whether the assessment is for short-term or long-term impacts. Then, in the upper left-hand angle of each box with a slash, the evaluator should place a number from 1 to 10, which indicates the magnitude of the possible impact, where 10 represents the greatest magnitude of impact and 1 the least (no zeros should be assigned). The scale of importance (placed in the lower right-hand angle of each box with a slash) may also range from 1 to 10, with the same principle applied – the higher the value, the higher the importance. Assignment of numerical value for importance is based on subjective judgment of a multi-disciplinary team working in the EIA. In addition to assigning the numerical values to each marked box, plus (+) or minus (-) sign can be used to show whether an impact is beneficial or adverse.

In this regard, for the analysis of possible impacts of certain activities and procedures during the construction and operation of the IWRMC, 11 possible activities on the realization of the proposed project, have been identified from a wider list of potential factors of impacts that can be expected for such type of interventions in the environment. Although it is possible to partially determine aggregate, i.e. average assessment of impact factors for each of these components, it is sufficiently appropriate and functional to present them as a whole. The fact is that some of them are synergistic ones, mutually reinforcing their effects, so that this matching of information should be maintained in the analysis. A synthetic presentation of endangering factors is given through mean values and not through aggregate assessment, which will be later scaled.

Furthermore, physical, biological and socio-cultural environmental characteristics of the subject location have been separated and, within them, 14 environmental components have been defined.

The significance of impacts is based on the calculated magnitude score for total impact area and impact activity. The significance is assigned based on the following total impact magnitude ranges. For ease of identification these ranges have been colour coded as shown in the (**Table 19**).

The steps involved are briefly summarised below:

- All Project related actions identified;
- associated environmental characteristics for each action identified;
- the magnitude of the impact was then determined by applying a number from 1 to 10 (1 is the minimum and 10 the maximum). This number is placed in the upper left-hand corner in the corresponding box of the matrix, representing the scale of the action and its theoretical extent. A plus (+) was used for positive impacts and a minus (-) was used for negative impacts; in the lower right-hand corner of each cell a number from 1 (least) to 10 (most) to indicate the importance of

the impact was placed. It then gives an evaluation of the extent of the environmental impact according to the judgement of the EIA team; and

- the significance was then determined by the joint consideration of its magnitude and the importance (or value).

These two factors have been applied as per the definitions given below.

Importance

In comparing relative importance of environmental impacts, the impacts have been characterised by considering the following;

- Duration over which the impact is likely to occur (temporary, short term, long term, permanent);
- timing or when the impact is likely to occur;
- spatial extent of the impact (such as on-site, local, regional, or national);
- frequency or how often the impact is predicted to occur;
- intensity (negligible, low, medium, high); and
- likelihood (certain, likely, unlikely, likely or very unlikely).

Magnitude

Magnitude of the impact was expressed in terms of relative severity, such as major, moderate or minor/negligible. In determining severity other aspects of impact magnitude, notably whether or not an impact is reversible and the likely rate of recovery are also considered. Hence, the following equation was used to determine the impact significance (UNEP, 2002).

$$\text{Impact characteristics (magnitude)} \times \text{Importance (value)} = \text{Impact significance}$$

The scores obtained for the magnitude of each of the impacts (both positive and negative) were categorized as given in **Table 17**.

Table 17 Categorization of the significance

Total magnitude score	Category
> 40	Major positive
20 to 39	Moderate positive
1 to 19	Minor positive
0	Negligible
-1 to - 19	Minor negative
-20 to - 39	Moderate negative
>- 40	Major negative

Significance categories given in **Table 17** is defined as explained in **Table 18**.

Table 18 Impact characterization matrix

Significance	Characteristics	
Major	An impact of major significance is one where an accepted limit or standard may be exceeded, or large magnitude impacts occur to highly valued/sensitive resource/receptors. A goal of the EIA process is to get to a position where the Project does not have any major residual impacts that would endure into the long term or extend over a large area.	Requiring appropriate mitigation measures
Moderate	An impact of moderate significance is one within accepted limits or standards. The emphasis for moderate impacts is on demonstrating that the impact has been reduced to a level that is as low as reasonably practicable.	
Minor	An impact of minor significance is one where an effect will be experienced, but the impact magnitude is sufficiently small (with and without mitigation) and well within accepted standards, and/or the receptor is of low sensitivity/value.	

Different colour codes have been used in the impact matrix to distinguish between positive and negative impacts as depicted in **Table 19**.

Table 19 Colour codes used for distinguishing positive and negative impacts

Significance categories	Colour code
Major positive	Green
Major negative	Red
Moderately positive	Blue
Moderately negative	Orange
Minor positive	Light Blue
Minor negative	Yellow
Negligible	

Cumulative Impacts

Cumulative impacts which may be defined as impacts that result from incremental changes caused by other past, present or reasonably foreseeable activities together with the project are generally considered in the impact assessment studies. The environment where the proposed IWRMC will be situated is relatively undeveloped area and no projects have been planned for the immediate future. Hence the proposed approach for assessing cumulative impacts was to consider those that had already been

completed. In this regard, the only foreseeable cumulative impact of the project had been identified to be in relation to the electricity consumption. Power needed for the IWRMC will be sourced from the island's existing power network. Considering the equipment that will require electricity at the IWRMC, it is envisaged that it would not have a significant impact on the island's power system. Long term additional power usage will have a cumulative impact on the greenhouse gas emissions which can contribute to climate change. However, such cumulative impacts on climate system are believed to be insignificant.

Impact Mitigation

EIA regulation requires practical and appropriate mitigation measures for significant impacts identified to be proposed in the ESMP. The Proponent is required to submit a letter of commitment in the ESMP report stating that all the mitigation measures proposed in the report will be implemented during all phases of the Project. Hence full implementation of the mitigation measures is considered an important condition for issuing the ESMP decision statement to proceed with the project. For each identified significant negative impact in proposing mitigation measures the priority was given to avoidance of a predicted impact by taking measures such as bringing changes to the design and/or work methodology. In cases where avoidance of an impact was not possible practical and cost-effective measures have been proposed to reduce the impacts and enhancing positive impacts. Practical experience and lessons learnt by the ESMP team from projects of similar nature played a key role in proposing mitigation measures.

In addition to predicting impact of the project on the environment, impacts of the environment on the project components for ensuring sustainability of the project was also considered.

Proponent's commitment letter confirming implementation of mitigation measures and monitoring responsibilities is provided in **Annex 8**.

Gaps in Baseline Information

Accurate impact assessment demands accurate baseline information collected over a reasonable period of time. However, even with the best effort to collect all relevant primary data required, inherent challenges make it almost impossible to have all such information collected within a relatively short period of time available to complete the assessment within the contract period to complete the study. Hence in certain cases it becomes necessary to make assumptions when limited or no information is available.

Understanding of the baseline conditions in studying existing environment was limited to a short period of time. Collecting all necessary environmental information is rarely possible due to time and cost constraints and therefore, the data captured is representative of the conditions at the time of the surveys. In the case of the present study, the data gaps have been adequately filled by experiences and lessons learnt from similar projects carried out in the Maldives.

Gaps in Understanding Impacts

Impact identification, characterization as well as significance analysis also involved uncertainties as ideally such an exercise should take place against a framework of criteria and measures established for the purpose in the relevant legislation which is not the case in the Maldives at present. Specified criteria necessary for impact evaluation such as environmental standards and thresholds are yet to develop in

order to strengthen the EIA process in the country. In order to address these gaps, where impact magnitude cannot be predicted with certainty professional experience and scientific literature was used and adapting criteria and measures from elsewhere that are relevant to local circumstances was used. In cases where a greater degree of uncertainty is believed to exist precautionary approach had been adopted in which likely maximum impact was considered.

Lack of compressive baseline information on all aspects of the Project environment was a critical setback in predicting impacts. However, developing and operating island level waste management centres is not uncommon in the Maldives and a lot of experiences have been gained in terms of actual impacts associated. Hence, in the case of present project uncertainties associated with the most significant impacts could be considered relatively small.

4.2. Potential Impacts and Mitigation Measures for Key Impacts

For every minor to moderate to major impact identified, a mitigation measure has been proposed and discussed below. The mitigation measures proposed would be strictly adhered to eliminate environmental impacts arising from the project, even before it occurs. The impacts and mitigation measures are detailed in the two stages, construction and operational stages as explained below.

The possible mitigation measures include:

- a) Changes in work practices and increasing awareness;
- b) Provision of environmental protection and health safety equipment; and
- c) Environmental monitoring during construction phase and operational.

Mitigation measures suggested in the report will focus on the existing environmental conditions as well as impacts that may rise during operation of the IWRMC.

4.2.1. Impacts and Mitigation from Construction Phase

Table 20 Impact Matrix for Construction Phase

Envisaged impact factors		C1 Worker Influx and Settlement	C2 Transportation of materials	C3 Site Demarcation & Fencing	C4 Construction	C5 Waste Generation	C6 Resource Consumption (Water, Electricity)	Total (Impact Area)
Physical Components	Seawater	-2	-4			-5		-11
		1	3			5		9
	Ground water	-2			-4	-4	-5	-15
		1			4	4	5	14
	Air	-3	-4	-1	-3	-5	-3	-19
		2	4	2	3	4	3	18
	Noise	-2		-1	-3	-2		-8
		1		2	3	2		8
	Coastal Zone						-1	-1
							1	1
Biological Components	Flora	-1	-1		-1	-1	-3	-7
		1	2		1	2	2	8
	Endangered species/protected areas							0
								0
	Coral Reef					-3		-3
					4		4	
	Fauna		-2		-1	-3		-6
			2		1	3		6
Socio-Cultural Component	Aesthetics	-2	-3		-7			-12
		2	3		5			10
	Accidents	-1	-6	-1	-6	-2	-1	-17
		1	5	1	4	2	1	14
	Landscape				-7		-7	-14
					7		8	15
	Health/Well being	-1	-6	-1	-5	-5		-18
		1	4	2	3	6		16
	Local economy	4	4	1	7		-2	14
		1	4	2	5		2	14
Total (Construction Activity/Risk)		-10	-22	-3	-30	-30	-22	
		11	27	9	36	32	22	

Summary of the multi-criteria analysis is given in **Table 21**.

Table 21 Summary of multi-criteria analysis for construction phase

Activity	Impact Score	Overall Impact
C4 Construction	-30	Moderately negative
C5 Waste generation	-30	Moderately negative
C6 Resource consumption	-22	Moderately negative
C2 Transportation of materials	-22	Moderately negative
C1 Worker influx & settlement	-10	Minor negative
C3 Site demarcation & fencing	-3	Minor negative

a) C4 Construction

There are a number of sub-activities that can affect the environment related to construction of the IWRMC. Overall, the multi-criteria impact magnitude for this activity was -30, which meant that it will have a moderately negative impact.

Material Storage

At the initial stage all resources required for the construction of the site will have to be procured and stored. These include construction materials, vehicles, machineries, fuels, and tools required for IWRMC construction. Due to the nature of the project, even though a large volume of construction materials is not required care must be taken in storing materials to avoid any potential damages to the environment. The improper siting of stockpiles and storage of sand, gravel, cement, fuel, etc., at the construction sites could lead to fine materials being lost, damaged during heavy rainfall events. This would not only represent a waste of resources but could also be a cause of project delays. Hazardous and flammable materials (e.g. fuel, paints, thinner, solvents, etc.) improperly stored and handled on the site are potential health hazards for construction workers and spilled chemicals would have the potential to contaminate soil and inhibit plant growth in localized areas.

Mitigation for material storage impacts

- Safe storage area should be identified and retaining structures put in place prior to the arrival and placement of material;
- the stockpiling of construction materials should be done in a such a way that the materials are not exposed to weather conditions and are properly controlled and managed by the site supervisors; and
- hazardous chemicals (e.g. fuels) should be properly stored in appropriate containers and these should be safely locked away. Conspicuous warning signs (e.g. 'No Smoking') should also be posted around hazardous waste storage and handling facilities.
- equipment shall be stored in fenced areas and maintained appropriately during the course of the project and no new such facilities shall be developed for the purpose of the project;

- National Fire Code (NFC) shall be strictly followed while handling, transporting and storing fuel. Inflammable goods such as fuel drums, portable fuel containers and cleaning solvents and chemicals will be closed off from public access.
- portable extinguishers placed to be readily available when someone finds a fire;
- fuel should be stored in well contained barrels and place over a concrete. This is to contain oil spills during storage and to prevent infiltration of oil into soil; and
- tool shed shall be locked and all the equipment, vehicles and tools must be accounted for.

Noise and vibration

It is important to identify the sources of noise and vibrations and the intensity of such impacts on the project island. The noise and vibration impacts are expected to be minor as the nearest residential area to the project site is 175 m away.

The main source of noise from the construction phase of the project will be from the engines used in the machinery and vehicles. No high impact works such as pile driving or demolishing structures are part of the proposed construction, therefore the impact noise is not a major source of noise pollution for this project. Typical noise level of construction equipment is detailed below:

Table 22 Typical construction equipment and their noise levels 50ft from the source

Equipment	Typical Noise Level (dBA) 50ft from source
Concrete mixer	85
Concrete pump	82
Concrete vibrator	76
Pump	76
Saw	76
Shovel	82
Tie Cutter	84
Truck	88

Assuming the highest noise produced during construction is at 85 dBA, a noise decay calculation was done using initial assumptions without factoring for dampening effects due to obstacles and vegetation. From the initial calculations, the noise levels are projected to decrease down to less than 59 dBA at the nearest residential area.

Noise during construction is determined to be a short-term negative impact. Due to the distance of the project site it is identified that noise impacts will be minimal to the residential zones, while the construction workers will be most affected by the noise impacts.

Mitigation Measures

- Confine construction activities to day time, from 8 am to 6 pm. Ensure no construction activities occur during night time; and
- Use of hearing protection by workers during the operation of heavy machinery.

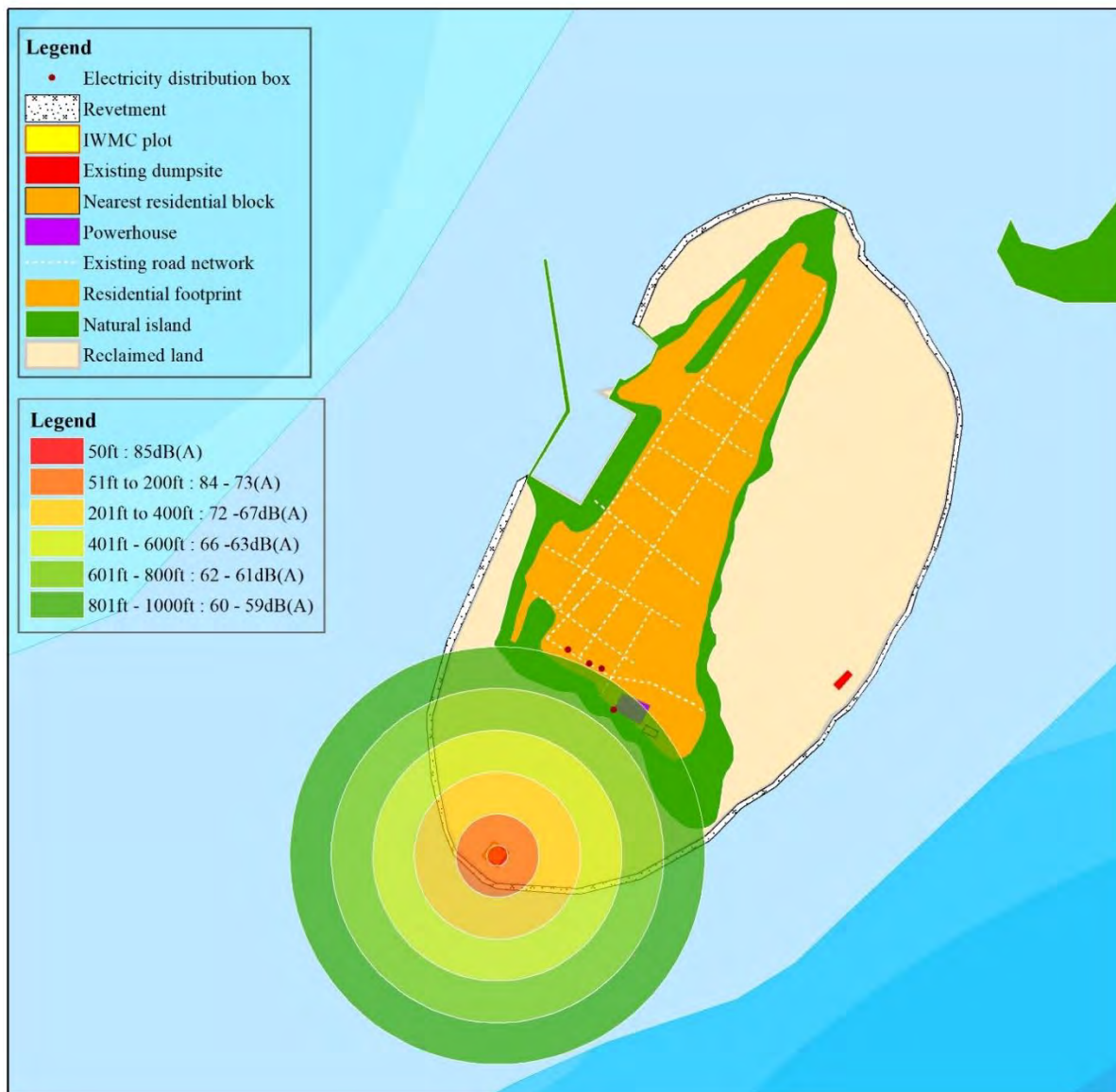


Figure 15 Noise range map for Th. Madifushi

Impact on vegetation

No vegetation is to be removed as part of this project. Careless workmanship may result in damages to the vegetation during movement of materials and other project related activities during the construction phase.

Mitigation Measures

- Workers shall be informed to avoid damaging trees and disturbance to animals and to generally avoid engaging in destructive activities to the environment intentional or unintentional.

Accidents and injuries

For a construction project of this nature there can be a number of causes that can result in accidents and injuries to workers. Hence it is imperative to identify and put in measures to avoid accidents and injuries to workers during construction phase. Some of the likely causes include:

- inhalation of cement during the site cast and pre-casting of concrete: inhaling high levels of cement dust during construction can be irritating to the nose and throat. Prolonged exposure to cement dust can result in silicosis (CSAO, 2001);
- contact with concrete mix: concrete has caustic, abrasive and drying properties and prolonged contact with concrete allows the alkaline compounds such as calcium oxide to burn the skin;
- wet concrete trapped against the skin can cause first, second, or third-degree burns;
- falling of heavy objects: constructions sites are prone to falling of heavy objects which can be fatal to workers;
- falls: workers may be under the risk of falling into open pits, trenches and seriously injuring themselves;
- Bodily injuries due to manual lifting of heavy items; and
- being struck by moving equipment and vehicles.

Mitigation measures

For all works the following safety measures will be required during the construction phase.

- Appropriate PPE will be worn at all times. This will typically include hard hats, eye protection, gloves and reflective clothing, hearing protection, safety harnesses, masks and wet weather clothing as appropriate;
- first aid kit will be on site at all times;
- all machineries will be operated by competent certified operators;
- manual lifting operations will be kept to minimum by the use of mechanical means;
- site visitors should not be generally allowed to work site except when its essential in such cases shall be accompanied at all times and required PPE shall be provided;
- proper signage and site demarcation should be provided around the site;
- carry out works during good weather;
- well trained personnel to use machinery and vehicles;
- avoid transportation during night; and
- securing any loads on vehicles during transportation.

b) C5 Waste Generation during Construction

Solid waste generated during IWRMC construction work would negatively impact the site and surrounding environment if not properly managed and disposed of at an approved dumpsite. Overall, the multi-criteria impact magnitude for waste generation was -30, implying that it will have a moderately negative impact. Waste burned onsite would generate smoke, possibly impacting negatively on ambient air quality and human health. Solid waste, if allowed to accumulate, could cause localised conditions conducive to the breeding of nuisance

and health-threatening pests such as mosquitoes. Poor construction waste management constitutes a short-term, possibly long-term, negative impact.

Vehicle, equipment and tools maintenance works will likely be the primary source of chemical wastes during the construction period. The majority of chemical waste produced is therefore expected to consist of waste oils, solvents and used batteries. Typical wastes may include the following:

- Solid wastes (Empty fuel/lubricant drums, used oil/air filters, scrap batteries, vehicle parts); and
- Liquid wastes (waste oils/grease, spent solvents/detergents and possibly spent acid/alkali from batteries maintenance).

However, the amount of chemical and hazardous waste produced will not be significant. Other construction waste includes, packaging, concrete, wood and steel in minor quantities.

Municipal wastes are also expected to be generated during the construction phase by the workers comprising of food wastes, packaging wastes and waste paper.

The amount of human waste generated per person is approximately 125 g/day, which means 1.9 kg will be produced daily if approximately 15 workers were active which equates to discharge of approximately 2,550 l/day of waste water. Sewage will be managed through existing septic tank systems that have been installed in the island.

Since there is no existing waste management system in the atoll and since there is no waste management practice in the island to accommodate the construction waste generated, the environmental receptors will have a significant burden from construction waste. Some of the hazardous oils if not disposed properly may cause health implications to the people and vegetation.

Mitigation Measures

- Ensure to manage waste as described in **Section 2.5.1 r** of the report;
- avoiding cooking and eating at work site to eliminate food waste and kitchen waste. Hence food for workers can be arranged with existing services on the island;
- reusable inorganic waste (e.g. excavated sand) should be stockpiled away from drainage features and used for in filling where necessary;
- regular sweeping of the of the worksite to collect litter, empty cans etc. which could become breeding ground for mosquitoes and other pests;
- open defecation whether it's on land or on the beach shall be prohibited;
- appropriate general site cleanliness related signboards could be placed on the worksite to give workers reminders on good waste management practices;
- ensure to reduce waste by following the 3R steps; and
- waste collected shall be transported to nearest waste management facility after the construction works have ended.

c) C6 Resource Consumption

Various types of construction related resources are required for the project. Consumption of goods impacts the environment in many different ways. For instance, materials used for the project would contribute, directly or indirectly through the product lifecycle, to climate change, pollution, and biodiversity loss and resource depletion locally or elsewhere in the world. The most important resource as far as the current project is concerned would be the allocation of land for the site. For the purpose of developing the waste management centre at least 735 m² of land would be required which represent 0.16% of the existing area. Allotting a plot of land for waste management with permanent concrete structures developed would essentially will result in a loss of the options for alternative land use and thus represents an irreversible commitment of land resources. The loss of optional uses for the allocated land although is inevitable is considered a negative impact. Other resources required would include sand, water, power and construction materials required for the IWRMC development. Since the resource utilization is considered to be relatively small, and that it is not expected to significantly contribute to deplete the natural resources and would be a major source of GHG emission, the multi-criteria impact magnitude for this activity was -22, which meant that it will have a moderately negative impact.

Since it would be very difficult to precisely determine by how much exactly the current project would contribute to the depletion of each type of various natural resources required for the project at local and global levels and by how much it would have contributed to global climate change, general impacts that are normally associated with natural resource use can be applied in relative terms for the project.

Mitigation

- Resource conservation shall be given a high priority in all stages of project development through bulk purchasing, putting in place measures to avoid wastage, encouraging reuse and recycling;
- initiate rainwater collection and storage as early as possible into the project construction;
- careful store management and record keeping on use of materials;
- reduce idle time for vehicles and equipment and switching off after use;
- use well maintained, energy efficient equipment and lights;
- sand shall not be mined from beaches and lagoons of the island for construction purposes, if coral sand is used it should be obtained from a government approved location;
- materials that are locally available shall be obtained as such instead of opting to bring those after a long haulage;
- materials shall be procured in bulk as much as possible;
- utilize day time hours for the construction when plenty of light is available; and
- FENAKA power supply will be used for electricity generating purposes.

d) C2 Transportation of Materials

Transportation of construction materials from the source to the project island is identified as an activity with climate impacts, through the transportation of sea vessels, as well the transportation of the materials on land. The use of vessels and vehicles would require burning of fossil fuels which result in the release of greenhouse gases (GHG) into the atmosphere. The fuel usage of a supply barge is estimated at 1.3 kWh /t. As a general rule the longer distance would mean more fuel burnt and more GHGs produced. As the resource sourcing hierarchy in **Figure 16** shows, the greatest importance shall be placed on sourcing any available materials from within the island, with the next option being from within the atoll, from islands such as Th. Thimarafushi. Next in the hierarchy is Male' and the industrial areas in the zone, from where majority of the remaining materials can be sourced. Lastly, in cases where a proposed material cannot be obtained from within the country, only shall the contractor procure the material from a neighbouring country which is not likely due to relatively small volume of material requirement and commonly available nature of those. The multi-criteria impact magnitude for this activity was -22, which meant that it will have a moderately negative impact.

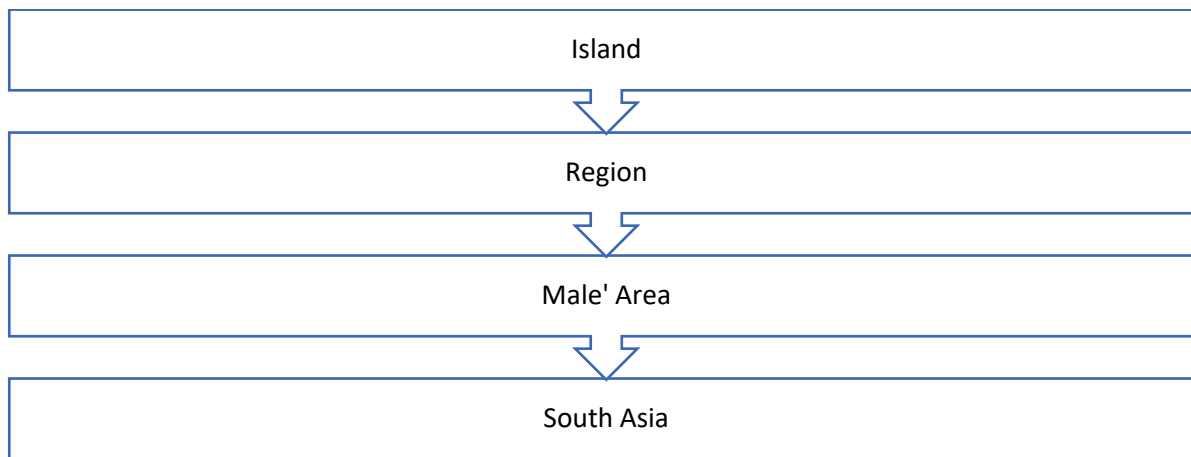


Figure 16 Material sourcing hierarchy proposed for the project

Along with the reduction in travel distances by choosing a close source, the number of trips to be made can magnify the distances travelled. The Proponent has produced the Bill of Quantities (BoQ) for the project works, which enables the contractor to purchase the required amount of materials in bulk, reducing the number of trips and wastage of materials. While the sea transport is expected to have the greatest impact of released GHG, the transport on land is expected to be minor, due to the short inland travel distances within the island.

The inputs of the project elaborated in the **Section 2.6** show the estimated amount of resources that will be used for the project. The use of resources for the project can have indirect impacts of GHG emissions from the production process. The main materials used in this project include concrete, reinforcing steel, structural steel, in addition to PVC pipes. Defra / DECC (2012) states that for every tonne of concrete casted, 135 kg of indirect CO₂ emissions result. Due to the small scale of the construction, the estimated indirect CO₂ emissions from material usage are minimal for this project.

The use of heavy vehicles on unpaved roads can cause compaction of the soil by the force applied by the tires of the vehicles. This can lead to the destruction of the soil structure, reduction of porosity, and thus reducing

the water and air infiltration into the soil. The resulting soil is dense with few large pores and poor internal drainage (Wolkowski & Lowery, nd.). Roads impacted with the traffic from heavy vehicles can thus result in undulations and puddling.



Figure 17 Impact on roads from heavy vehicle transport in an island in Maldives

For the purpose of construction, no heavy vehicles are proposed. Although this is the case, a pickup truck will be used to transport the construction materials to the site, in addition to yard waste and construction waste from the site. The vehicle is not expected to cause major impacts on the road, force applied by the pickup truck is expected to be lower than heavy vehicles and plant. The number of trips required are also reduced in the case of the proposed project, due to the small scale of construction.

Other impacts on roads due to transportation include the generation of dust during transportation, which can lead to impacts on the local air quality especially during dry weather. In addition to this, littering of construction materials from uncovered transportation vehicles can cause terrestrial pollution and amenity impacts.

Mitigation for climate impacts

- Sourcing of materials shall be done according to the hierarchy presented in **Figure 16**. Materials shall be obtained from the closest source;
- The materials shall be bought in bulk and transported to the island within a single trip where possible;
- Detailed BOQ produced by the Proponent shall be followed by the contractor when purchasing materials in order to reduce wastage of materials as well as the number of trips;
- The materials shall be stored on the project site to eliminate transportation of vehicles within the island throughout the construction phase;
- Idle time of the vehicles shall be avoided in order to reduce emissions;

- contractor shall emphasise on using vehicles hired from the island, instead of bringing their own vehicles, which would be beneficial to the community as well.
- contractor shall use serviced vehicles and plant equipment for the project;
- contractor shall only use the needed amount of vehicles and plant for project; and
- vehicle used for the purpose should comply with the roadworthiness requirements of the Transport Authority and display the compliance stickers.

Mitigation for impacts on roads

- The contractor shall only bring in the necessary number of vehicles and plant to the island for the project;
- it shall be stated in the contract that any damages to the roads from transportation of construction materials and machinery shall be assessed after the civil works are completed, and the damages shall be repaired by the contractor;
- use the closest route from the harbour area to the site;
- cover the materials being transported to and from the site; and
- spray water on the road surface during dry periods to suppress dust.

Mitigation for accidents and injuries

- Vehicle drivers shall be licensed and competent;
- loads being transferred shall be fully secured; and
- transportation shall be done during day time as far as possible; and
- speed limits shall be observed when operating vehicles especially in residential areas.

Mitigation for marine and terrestrial pollution

- contractor shall clean any littering on the terrestrial or marine environment caused during transportation; and
- contractor shall enforce strict policy against littering and appropriate penalties; and

e) C1 Worker Influx and Settlement

A large number of work force is not expected for the project. An estimated 10-15 workers will be required for this project. Since resource consumption, waste generation and behaviour related impacts on the environment are likely to have an incremental increase with additional people to the island. However, even though minor workers related negative impacts can range from damage to flora and fauna of the island, impacts associated with resource utilization, waste generation and potentially negative social impacts. On the other hand, even though small, more people to the island could have a positive effect on the local economy. Multi-criteria impact analysis shows that this activity will have an overall minor negative impact with a score of -10.

For the duration of the project, the workers related waste output is detailed in **Section 2.5.1 r**. For this project, worker related impacts can be reduced through the following mitigation measures.

Mitigation for impacts on flora and fauna

- The contractor is required to keep the workforce as minimum as possible, and to not bring in any surplus workers for the project;
- the project island currently has vacant properties as well as rooms to let in houses, which can easily house the influx of 10-15 workers. Therefore, no new facilities will be made for the accommodation of the workers in order to avoid clearing of land or spending resources unnecessarily for making worker quarters;
- all construction workers and persons on site must be given specific instructions not to catch or harm birds and animals allow them to retreat into undisturbed areas and prohibit damaging vegetation that are not;
- rules shall be formulated by the contractor and workers shall be oriented on the rules and conduct during the project works;
- enclosed containers shall be provided to dispose of waste oil and other hazardous waste;
- workers shall be given instruction not to catch or harm any birds or animals present on the island, and not to damage any vegetation that is not already sanctioned for removal within the demarcated site bounds;
- littering shall be prohibited; and
- waste bins shall be placed within the site.

Mitigation for impacts on resource use

- Reducing, reusing and recycling of resources shall be encouraged through proper monitoring of worker activities and awareness; and
- Keep workforce to the minimum required.

Mitigation for sociocultural impacts

- hire local workers where possible;
- orient foreign workers on communication, personal hygiene and sanitation and infectious diseases; and
- ensure all foreign workers have their legal permits.

f) Labour Related Impacts

Impacts related to interactions between the workforce and the local community may include:

- Transmission of HIV/AIDS and other sexually transmitted infections (STIs) and other vector borne communicable diseases;
- Tension and conflict between communities and employees of contractor;

- Delays in payment of rent and/or equipment hired from the island; and
- Health and safety accidents and incidents associated with project activities, such as increased vehicle movement on public roads etc.

Other labour related impacts during construction phase may include:

- Exposure of workforce to potential harm, injury, ill-health and to enjoyment of human rights etc.; and
- Exposure of workforce to poor accommodation standards. Exposure of workforce to inadequate OHS standards;

Mitigation measures

During construction the management of impacts related to labour and accommodation conditions and OHS for the workforce will focus on the establishment of relevant policies and monitoring systems and corrective actions. These will include:

- The development of an OHS management system and OHS monitoring and surveillance program;
- Fitness-for-work health screening;
- The development of a worker health awareness program;
- The development of worker engagement procedures;
- Development of a worker feedback mechanism;
- The development of relevant Human Resource (HR) policies and procedures;
- The development of a worker code of conduct;
- Accessibility to water and sanitary facilities where the contractor must identify a toilet accessible to the workers within 5 minutes from the site. This could be facilitated via renting a toilet from a nearby area (such as a utility office building / a house), installing a portable toilet at the site, making transport readily available to the accommodation building (via providing a vehicle) etc.; and
- Onsite resting area shall be provided for the workers, where they can rest between breaks and have snacks. This can be achieved by constructing a temporary shed and provide chair.

g) C3 Site Demarcation & Fencing

Site demarcation and preparation involves surveying and setting the extents of the IWRMC. This activity is considered to have minor environmental impacts with multi-criteria impact analysis score of – 3 as it is largely non-invasive.

However, improper or inaccurate demarcation could result in the IWRMC plot being set outside the limits as proposed by the EPA. It is important to ensure that the buffers proposed by the EPA are followed during site demarcation.

With proper planning, engaging qualified people and use of proper equipment, and with proper protective measures these impacts can be avoided. This activity is expected to have a minor impact overall.

Mitigation measures

- Ensure that the surveyors and helpers engaged in site demarcation properly understand the scope of works and recommendations of this report;
- qualified surveyors shall be engaged in site demarcation;
- accurate and reliable equipment shall be used to minimize errors; and
- carrying out the works during the day time.

Summary of Construction Phase Impacts and Mitigation measures

The table below provides a summary of the mitigation actions recommended to mitigate significant impacts during construction phase.

Table 23 Summary of ESMP for Construction Phase

Environmental Management Plan			
Impact	Mitigation Measure	Responsible Party	Cost of Mitigation
<i>Management of Impacts during Construction Phase</i>			
1. Physical / Chemical			
Note: All construction activities should be undertaken in the presence of an experienced supervisor.			
Contamination of groundwater and soil due to chemical spillage and seepage	<p>Hazardous waste such as waste oil and diesel should be stored in sealed containers and placed on an impermeable surface and transferred to the nearest regional waste management facility for final disposal.</p> <p>Stored containers should be regularly inspected to identify any leakages. Conspicuous warning signs (e.g. 'No Smoking') should also be posted around hazardous waste storage and handling facilities. A 10 x 20m temporary area for storage of such waste shall be developed close to the project within Zone 54.2 of the LUP (allocated for waste management).</p>	P: Contractor S: IC Supervisor	Cost associated with purchasing of containers and transport to RWMF
Noise pollution due to construction activities and use of machinery	<p>Ensure construction activities occur between 8 am and 6 pm.</p> <p>Construction workers should wear ear muffs when using machinery that produce significant noise and while undertaking welding and drilling activities.</p>	P: Contractor	Cost associated with purchasing ear muffs
Negative impact on air quality during transfer of construction materials and progression of works	<p>During transport of construction materials from the harbour to the site, all sand and aggregate should be transported in covered vehicles or wheelbarrows and vehicle movement should be via routes that are well away from community roads where possible. Transportation should be at low vehicular speeds and loading and unloading should be conducted within the site.</p> <p>All vehicles used in the project should have an up to date road worthiness certificate.</p> <p>All vehicles and machinery should be well tuned. Machines should be switched off when not in use.</p> <p>Ensure that construction site is regularly wetted to minimize impact of dust as a result of the project.</p>	P: Contractor	No cost involved.

	<p>Materials that are stockpiled at the location for long period of time should be covered to minimize impact of dust generation due to windy conditions.</p> <p>The contractor should not burn any waste.</p>		
Coastal erosion and loss of beach aesthetics due to sand mining	<p>Ensure that all construction materials including sand are sourced in compliance with the national laws and regulation.</p> <p>Sand should not be sourced from the beach or lagoon of an inhabited island, tourist resort, or any protected island. This includes the area of the island designated by EPA for sand mining of local public use.</p>	P: Contractor	Cost associated with purchasing sand from a reputable source (hardware shops) and transporting to the island.
Waste Management	<p>Construction waste produced should be reused for the construction of the IWRMC as much as possible. The remaining reusable materials such as (metal bars and roofing sheets) should be given to the island community or the island council free of cost.</p> <p>Leaves of felled vegetation is to be sundried and left at the forest area for natural degradation.</p> <p>Any remaining C&D waste shall be disposed at the area designated by the council for C&D waste disposal.</p>	P: Contractor S: Island Council	Cost associated with transport to RWMF
Littering and general waste generated by construction workers	<p>Place a bin at the site to dispose general waste generated by the workers.</p> <p>Establish procedures for general waste disposal which should include actions to be taken if the procedures are breached.</p>	P: Contractor	Cost associated with purchasing a bin
2. Biological			
Negative impacts to vegetation due to improper handling and driving during material transportation.	<p>Workers will be informed to avoid damaging trees and disturbances to animals and to generally avoid engaging in destructive activities to the environment intentional or unintentional.</p> <p>Avoid roads with significant vegetation during transportation within the island.</p> <p>Avoid bringing heavy vehicles to the island where possible.</p>	P: Contractor	No cost involved
Negative impact on	Workers will be informed to avoid damaging trees and disturbances to animals and to generally avoid engaging in destructive activities to the environment intentional or unintentional.	P: Contractor	Cost associated

fauna during material transport	<p>Materials shall be obtained from the closest source. Refer to Figure 15 for the recommended hierarchy.</p> <p>The materials shall be brought in bulk and transported to the island within a single trip where possible.</p> <p>The materials shall be stored at the project site or in a close proximity to avoid unnecessary movement of vehicles within the island through the construction phase.</p> <p>Ensure that all construction materials imported to the island are free of any alien species or pests.</p> <p>Ensure that oils and paints are properly sealed prior to transportation.</p> <p>Ensure that materials are not kept beyond the height of the sides of the vessels and are properly covered, when transporting via sea.</p>		with purchasing of containers designed for storing hazardous substances.
3. Health and Safety			
Occupational Health and Safety	<p>All workers should be provided with safety gear and should ensure that safety gear is utilized at all times. This includes: safety hats, boots, glasses, masks and gloves.</p> <p>Ear muffs shall be provided where equipment or machinery that emit significant amount of noise is used (welding, drilling etc.).</p> <p>Chemical-Liquid protective gloves should be used when handling any chemicals, waste oil or other liquid waste.</p> <p>First aid kit must be purchased and kept on site at all times</p> <p>No open electrical wiring or cables should be kept on site.</p> <p>Health and Safety briefing should be given to all construction workers.</p> <p>A safety inspection checklist should be prepared taking into consideration what the workers are supposed to be wearing and monitored monthly and recorded in the monitoring.</p>	P: Contractor	Cost associated with purchasing safety materials.
Working Conditions and Labour	<p>The maximum working hours of all construction workers should be 48 hours per week as per the Employment Act of Maldives.</p> <p>Meals should be provided to construction workers 3 times a day.</p>	P: Contractor	

	<p>Safe drinking water should be supplied to construction workers and must be made available at the work site and the labour camp.</p> <p>Appropriate sleeping arrangements shall be made for the construction workers.</p> <p>Accessibility of workers to water and sanitary must be ensured the contractor. As such, a toilet accessible to the workers within 5 minutes from the site must be identified and facilitated through renting a toilet from a nearby area (such as a utility office building / a house), installing a portable toilet at the site, making transport readily available to the accommodation building (via providing a vehicle) etc</p> <p>Onsite resting area shall be provided for the workers, where they can rest between breaks and have snacks. This can be achieved by constructing a temporary shed and provide chair.</p>		
Management of COVID19	<p>Travel permit must be taken from HPA for the workers if traveling from Male' or an island placed under COVID19 monitoring. The standard quarantine procedure must be followed as instructed by the authorities.</p> <p>Workers must be briefed about the safety protocols and social distancing measures that has to be enforced.</p> <p>The workers must perform frequent hand hygiene.</p> <p>All workers must wear face masks.</p> <p>The movement of workers must be restricted between the labour camp and work site as much as possible.</p> <p>Daily body temperature of all the workers should be taken and log records maintained. If a worker is having a temperature of 37.8C or above or symptoms of flu that person must not report to work and should be self-isolated and respective authorities notified.</p> <p>Handwashing or hand sanitizing facilities must be established at the work site and the labour camp.</p> <p>Labour camp should facilitate social distancing. The beds should be kept at least 3 – 6 fts apart.</p> <p>COVID19 awareness materials should be displayed in the worksite and the labour camp.</p> <p>Construction tools should be cleaned using disinfecting solution (1:9 bleach solution) at the end of each day or when changing shifts (if shift-based work methodology is adopted).</p>	P: Contractor	Cost associated with purchasing soap, hand sanitizers etc. and printing of awareness materials.
Health and safety of public	<p>Demarcate the site boundary through taping, hoarding or fencing.</p> <p>Place sign boards to indicate that only authorized personnel are allowed entry.</p>	P: Contractor	Cost associated with

	<p>Make sure that the general public do not have access to the site and its vicinity. Regularly monitor for entrance of residents.</p> <p>Make sure that public chairs are not found at the vicinity of the site.</p>	S: Island Council	designing and printing sign boards.
Fire hazard	<p>Ensure that electrical wires are installed properly by a certified person.</p> <p>Ensure that portable extinguishers are readily available in case of an emergency fire.</p> <p>Flammable hazardous waste such as used oil and diesel must be labelled with hazardous waste and fire hazard signage and regularly inspected to identify any leakages. Conspicuous warning signs (e.g. 'No Smoking') should also be posted around hazardous waste storage and handling facilities.</p> <p>National Fire Code (NFC) shall be strictly followed while handling, transporting and storing fuel. Inflammable goods such as fuel drums, portable fuel containers and cleaning solvents and chemicals will be closed off from public access.</p>	P: Contractor	Cost associated with hiring an expert electrician and purchasing of fire extinguishers
4. Sociological and Cultural			
Legal Issues	All expatriate workers must hold valid work permits	P: Contractor	Work Permit fees
Handling Environmental and Social Issues during Construction	<p>The contractor will appoint a suitably qualified Environmental Officer following the award of the contract. The Environmental Officer will be the primary point of contact for assistance with all environmental issues during the pre-construction and construction phases. He/ She shall be responsible for ensuring the implementation of ESMP.</p> <p>The contractor shall appoint a person responsible for community liaison and to handle public complaints regarding environmental/social related matters. All public complaints will be entered into the Complaints Register. The Environmental Officer will promptly investigate and review environmental complaints and implement the appropriate corrective actions to arrest or mitigate the cause of the complaints. A register of all complaints is to be passed to the Engineer within 24 hrs. They are received, with the action taken by the Environmental Officer on complains thereof; and</p> <p>The site supervisor may assume the on-site responsibility of the environment officer and community liaison officer, subject to being adequately trained and having thorough knowledge of the ESMP.</p> <p>Contractor shall prepare detailed Environmental Method Statement (EMS) clearly stating the approach, actions and manner in which the ESMP is implemented.</p>	P: Contractor	Cost associated with hiring of staff.
Sociocultural conflict due to arrival of	Ensure that local workers are used as much as possible. If expatriate workers are used ensure that they respect the local culture.	P: Contractor S: Island Council	Cost associated with hiring staff

<p>expatriate workers</p>	<p>The contractor in collaboration with the Island Council shall undertake a training to sensitize the labour to the local context and customs. This training should also cover topics related to Gender-based violence.</p> <p>To mitigate conflict that may arise due to the arrival of expatriate workers, the consultant should develop a “Code of Conduct” outlining the set of rules that that the workers have to follow to persevere the social norms and religious values of the society. The Code of Conduct should also specify penalties for breaching these rules and should be thoroughly communicated to workers prior to mobilization.</p>		
<p>Code of Conduct and Communication</p>	<p>The “Code of Conduct” developed should also cover good environmental governance and responsibilities workers have to follow to safeguard the environment. Though the number may be minimal, code of conduct and awareness in HIV related issues need to be considered.</p> <p>The contractor should ensure that all communications to the workers are presented in the local language. If expatriate workers are employed communications should be made in a language that they understand.</p> <p>Information on the project and the GRM should be displayed in the project site board, council noticed board as well as other communal place as much as possible.</p>	<p>P: Contractor</p> <p>P: Island Council S: MCEP</p>	<p>Cost associated with developing materials.</p>
<p>Loss of source of sand for local public use due to sand mining from the area of the lagoon permitted for local public sand mining</p>	<p>Ensure that sand is not taken from the lagoon of the island.</p>	<p>P: Contractor</p>	<p>Cost associated with purchasing sand from a reputable source (hardware shops) and transporting to the island.</p>
<p>Grievance Redress Mechanism</p>	<p>The GRM established by the proponent should be implemented at the construction phase. Contact details of focal points of the contractor, Island Council and the proponent should be displayed at the project site in the project board, the Council Office and common places frequented by the public (such as schools, health centre etc.).</p> <p>It is recommended to change the first point of contact to the contractor, followed by Island Council and the proponent. The community liaison officer of the contractor must maintain log records of the complains received and subsequent actions taken.</p>	<p>P: Contractor S: Island Council T: Proponent</p>	<p>Cost associated with printing of the GRM board and posters.</p>

5. Economic			
Benefit to local economy	Ensure that construction materials are purchased from the island as much as possible. Preference shall be given to hire local construction workers from the island and the atoll or region.	P: Contractor	Cost associated with material purchase

4.2.2. Impacts and Mitigation from Operational Phase

Table 24 Impact Identification Matrix for Operational Phase

Envisaged impact factors		O1 Waste collection and transportation	O2 Waste sorting, separating and composting	O3 Waste generation	O4 Resource consumption	O5 Operational Staff Influx / Settlement	Total (Impact Area)
Physical Components	Seawater	9					9
		9					9
	Ground water	8	-2	-1	-3	-2	0
		5	2	5	2	1	15
	Air	-3	-2	-2	-3		-10
		5	3	2	4		14
	Noise	-3	-1				-4
	4	2				6	
	Coastal Zone						0
							0
Biological Components	Flora	6	7	-1	-3	-1	8
		2	6	1	3	1	13
	Fauna	5	5	-1	-3	-1	5
		5	5	1	3	1	15
Socio-Cultural Component	Aesthetics	9	8			-2	15
		9	6			2	17
	Accidents	-4	-4		-4	-1	-13
		4	4		5	1	14
	Landscape	9	6	-1			12
		6	5	2			13
	Health/Well being	9	-5	-2	-4	-2	-7
		6	5	2	7	1	21
	Cultural heritage					-1	-1
					1	1	
Local economy	-3	8	-2	-1	2	4	
	9	5	4	1	1	20	
Total (operational Phase Activity/Risk)		42	20	-10	-21	-8	
		64	43	17	25	9	

Since the overall objective of the project is to establish economic viability and environmental sustainability of the proposed waste collection, transfer and disposal systems to prevent impacts on human health and environment through approaches that are sustainable and locally appropriate, the operational phase of the project is expected to yield overall positive outcomes. In this regard, the proper management of waste sorting, collection, transport and disposal in the new system will reduce potential environmental and health impacts from waste. Furthermore, a safer and better environment will promote business, especially tourism, in the area and create better livelihood conditions. However, as summarised in **Table 25**, the operation of the waste management system itself will result in certain negative environmental impacts which will have to be managed properly through appropriate mitigation measures to ensure that those negative impacts are kept at an acceptable level. The paragraphs below briefly discuss the likely impacts and proposed mitigation measures.

Table 25 Summary of multi-criteria analysis for operational phase

Activity	Impact Score	Overall Impact
O1 Waste Collection & Transport	42	Major positive
O2 Waste sorting, separation, and composting	20	Moderately positive
O4 Resource consumption	-21	Moderately negative
O3 Waste generation	-10	Minor negative
O5 Operational Staff Influx / Settlement	-8	Minor negative

a) O1 Waste Collection and Transportation

As stated in this report, a demarcated area has been built in Madifushi with compartments for separated metals, glass and plastics. During the visit it was observed that this area was completely filled up during the two years of its operation. The operation of the dumpsite as well as cleaning of the public spaces is being conducted by the Women’s Development Committee. The council stated that the dumpsite has filled up due to there being no way to reduce the volume of the waste, nor there being any way to transport the waste out of the island. As the dumpsite has been filled, waste is now being dumped in the open area next to the demarcated area. The practice of open burning of waste also takes place resulting to potential respiratory issues from the inhalation of smoke. Hence a reliable, affordable and locally appropriate transport system is critical to collecting waste from houses, businesses and institutions. Equally important is an arrangement for marine transport to remove residual waste from the island in order to make the system complete and effective. The successful implementation of the IWRMC together with land and marine transfer arrangement are two important aspects to implement Waste Management Plan to make the island cleaner and healthier for the people to put a stop to littering and burning of waste in the island. This will lead to the improved health and psychological well-being of the residents and

visitors of Madifushi. It has been identified as a long-term positive impact on the residents and visitors of Madifushi.

A vehicle will be obtained for the purpose of collecting and transporting the waste within the island daily, at a set schedule. At the moment there is no specific arrangement for marine transfer of residual waste from the island although by the time IWRMC is complete it is expected to have this arrangement in place. The multi-criteria analysis shows waste transport arrangement will have a major positive impact with an overall score of 42.

While both land transport and marine transfer of waste are expected to have significant positive impacts, unregulated transport arrangements can result to environmental issues. If not properly managed, likely environmental impacts include, noise, hardening of road surface, creation of puddles during wet season, and littering on the roads, bad odour during transport, and health issues to workers, vehicular emission, dust generation as a result. In the case of marine transport, there can be chances of dumping of waste intentional or unintentional en-route to the final disposal site in addition to engine emissions. However, these impacts can be effectively managed and negative impacts can be kept at an acceptable level.

Measures to ensure and enhance the positive impacts

- Island Council shall follow the management plan provided with the ESMP in order to monitor the operations of the IWRMC, and bring about any necessary changes to the operations and policies, in addition to providing any needed technical assistance for the island;
- Proponent shall review the waste management operations within the island regularly and update the National Waste Database;
- Island Council shall review and update the IWMP by consulting relevant stakeholders and get it subsequently approved from EPA;
- Island Council shall conduct awareness programs to the residents of the island regarding the best practices in waste management, as well as conduct programs to familiarize the residents with the gazetted regulations and guidelines to manage the waste within the island;
- regular awareness programs conducted to minimise waste generation and Polluter pays principle established in order to reduce the waste generation within the island;
- Proponent shall provide resources in terms of required equipment, machinery, and technical expertise to ensure the operation of the IWRMC; and
- Proponent shall assist in creating markets / avenues where the IWRMC can generate income through selling compost and recycled metals, plastics and glass.

Mitigation for terrestrial pollution

- Implement rules within the IWRMC workers to impose penalties for any littering within the island due to improper handling of the waste and improper transport practices;
- the status of the vehicles used shall conform to the Waste Management Regulations 2013/R-58 and provide cover to the waste being transported in order to avoid littering;

- during waste collection instead of stopping the vehicle at every house, the residential area can be divided into blocks and vehicle stops can be pre-determined and from where waste containers can be hand carried by the workers from respective houses to be loaded to the vehicle.

Mitigation for accidents and injuries

- Waste collecting workers shall wear appropriate clothing and PPE to avoid injuries in handling waste;
- vehicles should be driven by licensed drivers;
- records of the vehicle trips shall be properly maintained;
- speed limits shall be observed; and
- a strict schedule shall be stated in the IWMP and followed in order to reduce the transportation frequency thus reducing the probability of accidents.

Mitigation for air quality impacts

- Vehicle speed shall be kept appropriately to suppress dust;
- vehicles used shall be regularly washed and kept clean; and
- The waste being transported shall be covered to minimise the impact of odour on the public.

Mitigation for climate impacts

- Regular servicing of vehicles used to transport waste;
- ensuring the vehicle has roadworthiness certification from the Transport Authority;
- restricting the use of the vehicle only for the stated time in the IWMP;

Measures to prevent marine pollution

- Wastes destined to the nearest waste management facility will require to keep logs of waste being loaded from the island and unloaded at the nearest waste management facility. The records to be signed by the vessel captain and a copy returned to the waste management supervisor;
- vessels used shall have a certified captain and vessel should have valid seaworthiness certificate;
- vessels shall not be overloaded and waste containers shall be kept closed and shall not be allowed to flyaway due to wind and sea conditions; and
- Waste shall not be transferred during extreme weather conditions.

b) O2 Waste Management Activities

Assuming that operations of the IWRMC will be properly resourced and functioning properly, the waste sorting, separating storing and composting will have an overall positive impact as shown by the multi-criteria impact assessment with a score of 20. On top of reducing the volume of waste, these activities,

will make resource recovery and ultimately a significant proportion of the waste becoming a valuable resource. These activities will be carried out in the IWRMC where employees will be trained to undertake these activities.

In general, the operational phase of the project will greatly improve the existing waste management condition of the island preventing pollution and spread of diseases. These activities would prevent pollution of groundwater, coastal areas and forested areas which would prevent impacts to biodiversity, health and wellbeing of the public.

However, if these activities are not properly implemented there is a risk of IWRMC being deteriorated into a dump site where mixed waste are disposed, burned and buried. This means without proper mitigation measures and regular transportation of waste out of the island to a central facility, there is a greater risk of IWRMC being overfilled. This entails a loss of investment and a greater impact to environmental receptors as some sites are moderately close to public areas. Propensity of these impacts are greater for the following environmental receptors:

- Groundwater;
- Climate/air; and
- Health and wellbeing: noise, odour and accidents/injuries

The following Sections describes the factors influencing these impacts and proposes measures to mitigate negative impacts and to ensure the overall positive impact of the IWRMC during operational phase.

Impacts on health

Overall positive impacts on public health are identified from this project, while the in-vessel composting method will ensure that some of the negative impacts associated with manual windrow composting are eradicated by:

- significantly reducing the level of exposure of the workers to raw organic waste that has the potential to transmit air borne pathogens;
- shortening the time required for compost production, thereby reducing the workload and manual labour, and;
- the end product being completely odourless.

Mitigation for health impacts

- A distance of 264m is available between the IWRMC and the nearest residential area, which is greater than the buffer zone proposed by Herr et al (2004) and Wheeler et al (2001), it is expected that bio aerosol concentrations will reduce to background level at the stated distance;
- site is located in such a way that winds from both monsoons blows the airborne particles from the IWRMC away from the residential zone; and

- workers will wear appropriate safety clothing, follow the workplace safety mechanisms and guidelines set by the contractor and practice safety and personal hygiene when handling the compost.

Impacts on groundwater

Sorting and processing of all type of waste received at the IWRMC will be carried out in fully enclosed paved areas, with adequate drainage systems installed, thereby effectively minimising any potential for groundwater pollution as a result of leachate generated from waste processing and handling during unprecedented weather. In addition to this, rainwater drains are installed at the open areas of the IWRMC. All the drains within the IWRMC are connected to either the leachate collection tanks or the septic tank. Therefore, the operation of the IWRMC is identified to have an overall positive impact of the groundwater of the island.

At present, waste has been dumped throughout the island without any measures, enabling the pollution of the groundwater with the leachate. Therefore, the proper operation of the IWRMC and the proper management of the collected waste will result in the reduction of the pollution of the groundwater from waste sources, thus improving the status of the groundwater in the island.

Mitigation for impacts on groundwater

- Ensure that waste is not being kept in the open areas of the IWRMC; and
- Ensure that the composting machine is being operated daily.

GHG emissions

The waste management activities will require power consumption for operation of the machines, lighting and pumping. Since the island's power system is fossil fuel based incremental increase in electrical energy consumption at the IWRMC will result in GHG emissions. However, the power consumption at IWRMC is expected to be small and therefore is not considered a significant issue.

Some amount of GHG will be released during the operations of the waste collection and transfer vehicle, which would be quite insignificant when considered cumulatively.

Amenity impacts

All waste processing area of the IWRMC will be fully enclosed, while the only open area of the IWRMC corresponds to a significantly minor proportion designated for the movement of the collection vehicle. Additionally, adopting the in-vessel composting method and designating a storage room exclusive to finished compost means that any potential negative amenity impacts associated with manual windrow composting such as huge piles of compost and untreated raw waste being visible is completely removed.

Therefore, no negative amenity impacts are envisaged during the operations of the project. In contrast, a fully functional IWRMC will contribute to the overall cleanliness of the island, by reducing potential for littering and unorganised dumping of waste to different parts of the island.

Mitigation for impacts on amenity

- Ensure that waste is not being kept in the open areas of the IWRMC.
- Ensure that the composting machine and the other operations of the IWRMC are being carried out daily or in a system manner, in order to avoid creating deposition of huge piles of untreated waste.

Air quality impacts

Odour

During traditional windrow composting, odours can originate from sulphur compounds, nitrogen compounds and volatile organic compounds. Ammonia is also commonly associated with unpleasant odour resulting from composting. If the composting is done under aerobic conditions, the main gaseous product is carbon dioxide. Gas compounds contributing to the odours of composting organics containing bio solids include dimethyl sulphide, dimethyl disulphide, dimethyl trisulphide, carbon disulphide and benzothiazole.

The proposed in-vessel composting method, will eliminate such potentials foul odours associated with manual windrow composting. It converts unsightly and odorous garbage into a beneficial material devoid of foul odours and unsightly appearance.

Furthermore, the proposed site is 264m away from the nearest residential area, therefore the impact of odour (even if generated) on the residential areas are deemed minimal.

Mitigation for impacts on odour

- Ensure that stock pile of raw organic waste is kept low and is not left untreated for longer durations.
- Ensure that staff involved in sorting of received waste and operations of the compost machine are wearing appropriate PPE including masks to mitigate any undesirable impacts of foul smell coming from raw organic waste.

Fire hazards

There is a possibility of fire hazards at the IWRMC coming from human activities. Fires can pose a risk to the workers through explosions and suffocation from smoke, in addition to damage to equipment.

Possible fire hazards are caused by the following (DCE NSW, 2004)

- Spontaneous combustion;
- Lightning strikes;
- Cigarettes; and

- Arson

The most common causes of fire during waste management activities are reported to be cigarettes and spontaneous combustion (Rynk 2000). The cause of spontaneous combustion is when the decomposing organics self-heat to ignitable temperatures (DCE NSW, 2004). As compost will not be stored in the open but in the proposed 14sqm ventilated area, such an event is extremely unlikely, although it is important to limit the storage of organic within the IWRMC. If the production exceeds the demand and the storage capacity of the IWRMC, excessive compost can be disposed in forested areas of the island which would ultimately enrich the soil condition of the island. The organic material produced by the proposed in-vessel composting method not only provides nutrients to the plants, it also improves the organic-carbon content and moisture retaining capacity of the soil

Potential for such fire hazards can further be mitigated by closely monitoring the waste management operations of the centre. CCTV cameras can be installed to ensure that best practice is followed and prohibited activities like smoking are not carried out inside the IWRMC. Furthermore, no smoking sign boards will be installed in the IWRMC and firefighting equipment will be supplied as part of the civil works contracts.

Mitigation for impacts on fire hazard

- A fire management plan shall be developed by the IWRMC operator;
- Adequate firefighting equipment shall be provided at the IWRMC, and placed at locations easy to access. The current design of the IWRMC includes firefighting equipment;
- Dispose excessive compost in forested areas, if production exceeds demand and storage capacity;
- Closely monitor the operational activities of the IWRMC to ensure that the rules and protocols established are being well followed by operational staffs, which could be further augmented by the installation of CCTV cameras;
- Signs shall be kept on the premises stating that open flames are not permitted on site. Install no-smoking sign boards in places where flammable waste such as paper / cardboard and compost are being stored; and
- Training and awareness raising on firefighting shall be conducted on a regular basis for the workers.

Noise and vibration impacts

The main sources of noise from the operation of waste management centres come from the material recovery machineries used and the operation of vehicles. According to the Health and Safety Executive UK, most material recovery facilities have noise levels exceeding 80 dBA and 85 dBA. Assuming a maximum noise level of 85 dBA, the noise decay map in **Figure 15** can be used for this purpose too. From the initial calculations, the noise levels are projected to decrease down to less than 59 dBA at the nearest residential area. Therefore, the long-term negative impacts of noise would be borne by the employees of the IWRMC, and the effects of noise to the residential areas are minimal.

Mitigation for noise impacts

- Obtain noise data from supplier prior to purchase of machinery;
- enclose the noisy machinery with sound insulating enclosure;
- reduce duration of exposure by implementing job rotation; and
- provide employees with hearing protection if required.

Workplace safety and accidents

The group of people most likely to be impacted by the IWRMC operations are the workers at the site. The various operations such as transportation, collection, handling, sorting and storing of the wastes, in addition to the composting and volume reduction operations all pose different risks to the worker onsite. The impacts discussed above and their proposed mitigation measures can provide a level of safety to the workers. Even with these mitigation measures put in place, a proper workplace safety guideline shall be formulated by the operator for all workers onsite to follow.

In addition to the impacts discussed above, other work-related safety issues include falling stock or during lifting activities, moving vehicles and falls from height. The accidents can result in injuries of varying nature.

Mitigation for workplace accidents

- The IWRMC occupier shall be required to develop occupational safety management plan, and safety guidelines shall be displayed in the work site at all times;
- provide clear instructions to the workers on:
 - The possible risks
 - Measures in place to control risks
 - Follow emergency procedures;
- provide proper training including manufacturer's safety instructions to employees on how to operate machinery;
- conduct proper and regular maintenance of machinery used;
- prior to maintenance, make sure the equipment is made safe and prevent access to dangerous parts. Make sure others are aware that maintenance is being carried out;
- machinery and vehicles should only be handled by employees with the proper credentials and training; and
- proper PPE should be provided at work. PPE should be used after all possible risks have been eliminated as much as possible and to manage any remaining risks.

c) O3 Waste Generation

Not considering the waste collected from the island, waste generated as a direct result of operations at IWRMC during the operational phase of the IWRMC will be relatively low. These will include waste oil/batteries for waste management equipment, yard cleaning waste, used spare parts, used clothes, etc. Since eating and cooking inside the IWRMC will be prohibited, no mixed municipal waste will be generated during the operational phase of the project. Hence overall impact for this activity would have a minor negative impact on environmental receptors. The multi-criteria impact analysis shows it would have a minor negative impact with an overall score of -10.

Mitigation Measures

- All wastes generated as a direct result of the waste management activities shall enter the waste management stream and managed as prescribed for different waste types; and
- prohibit eating/cooking in the IWRMC.

d) O4 Resource Consumption

Electricity, fuel and water will be directly required for the operation of the IWRMC. Water will be mainly sourced from the ground while electricity will be obtained from the island's mains.

Water will be mostly required for cleaning purposes and volume of water required for these will be relatively small. The curing system of Excel's compost machine, where the output from the compost machine is kept for 10 – 12 days for making final compost, has an automatic fogging system, thereby reducing the volume of water required for compost production compared to traditional methods. It is estimated that approximately 200 -300 l/day of ground water will be required during the operational phase of the project. Since the volume of water required is relatively low, it is not expected to have a significant impact on groundwater.

A compactor and shredder/crusher can be used to reduce the volume of waste streams. The waste weight will remain the same so there will be no savings from the total amount of waste produced. However, savings will occur because waste volume will be reduced by approximately 80% which will decrease the number of times the storage area is required to be emptied, therefore resulting in lower transportation costs.

Depending on the type of equipment's used such as chainsaws will require small volumes of fuel for operations. Most of these equipment's, however, are run very infrequently when enough waste has been separated and stored and are relatively efficient when run, meaning the amount of energy consumed by the compactor will be low. The running wattage mid-range compactors and shredders may range from 700 – 2000 watts, which means approximately 30-60 kW will be required to power all equipment simultaneously. However, this will not be the case since many of this equipment don't need to be switched on daily and at the same time. There may be periods where the only electricity required will be for

switching on the lights at the IWRMC. Therefore. Electricity consumption of the IWRMC during the operational phase will be relatively low. The activity would have a minor negative impact on environmental receptors.

However, the following mitigation measures shall be implemented to reduce water and electricity consumption.

Mitigation Measures

- It is strongly encouraged to install solar panels on the IWRMC roof to generate required power for the IWRMC;
- use solar lights in the premises;
- work shall be planned to be carried out during day times;
- ensure that the curing system is purchased along with the compost machine;
- ensure that stock of bioculum is maintained to cover for a period of 1 year;
- ensure that all equipment is serviced and kept clean daily, to reduce the amount of water required for cleaning;
- prepare a plan to switch on the compactors and shredders depending on the incoming waste stream to conserve electricity; and
- make sure all equipment are properly serviced and maintained.

e) O5 Operational Staff Influx / Settlement

If expatriate workers are selected for operations of the centre, social and labour related impacts identified for the construction phase will prevail in the operational phase as well.

Impacts related to interactions between operational staff and the local community may include:

- Transmission of HIV/AIDS and other sexually transmitted infections (STIs) and other vector borne communicable diseases;
- Tension and conflict between communities and employees of contractor;
- Delays in payment of rent and/or equipment hired from the island; and
- Health and safety accidents and incidents associated with project activities, such as increased vehicle movement on public roads etc.

Other labour related impacts during construction phase may include:

- Exposure of workforce to potential harm, injury, ill-health and to enjoyment of human rights etc.; and
- Exposure of workforce to poor accommodation standards. Exposure of workforce to inadequate OHS standards.

Mitigation measures

The following mitigation measures are recommended to be adopted

- Hire local staff where possible;
- Orient foreign workers on communication, personal hygiene and sanitation and infectious diseases;
- Ensure all foreign workers have their legal permits;
- The development of an OHS management system and OHS monitoring and surveillance program;
- Fitness-for-work health screening;
- The development of a worker health awareness program;
- The development of worker engagement procedures;
- Development of a worker feedback mechanism;
- The development of relevant Human Resource (HR) policies and procedures; and
- The development of a worker code of conduct.



Summary of Construction Phase Impacts and Mitigation measures

The table below provides a summary of the mitigation actions recommended to mitigate significant impacts during operational phase.

Table 26 Summary of ESMP for Operational Phase

Environmental Management Plan			
Impact	Mitigation Measure	Responsible Party	Cost of Mitigation
<i>Management of Impacts during Operational Phase</i>			
1. Physical / Chemical			
<p>Waste processing and storage.</p> <p>Litter, odour and vector nuisance.</p>	<p>Ensure that intra island waste collection services are provided at least daily.</p> <p>Secondary transfer to a regional facility shall be arranged every 4 – 6 months.</p> <p>Waste collection vehicles and transfer vessels must be secured from all sides to prevent spillage. The status of the vehicles used shall conform to the Waste Management Regulations 2013/R-58 and provide cover to the waste being transported in order to avoid littering;</p> <p>During waste collection instead of stopping the vehicle at every house, the residential area can be divided into blocks and vehicle stops can be pre-determined and from where waste containers can be hand carried by the workers from respective houses to be loaded to the vehicle.</p> <p>Adequate bins with closures must be provided at the drop off locations if the IWMP has demarcated them.</p> <p>Provide adequate training to all laborers involved in operating the waste management equipment / machineries.</p> <p>Undertake regular maintenance of the waste management equipment.</p> <p>Control of the incoming waste stream is necessary to ensure safe and effective processing, treatment, and disposal of the Waste and the quality of end products (e.g., quality compost).</p>	<p>P: Island Council/ IWRMC Operator</p> <p>S: MCEP (for delivery of training on WM equipment / machineries)</p>	<p>Cost associated with IWRMC operation</p> <p>Cost of providing training</p> <p>Cost associated with purchasing jumbo bags and/or containers</p>

	<ul style="list-style-type: none"> • Visually evaluate, weigh, and document incoming waste loads; • Conduct visual inspection of the incoming waste, along with sorting and removal procedures, can minimize this potential hazard; • Analyse suspected hazardous materials before acceptance so that they are segregated relative to compatibility and so that they can be adequately treated and disposed of; • Separate recoverable secondary materials for recycling and organic waste for composting to the extent practical. • Waste that cannot be managed at island level must be processed (chipped, crushed or compacted) and stored in the inorganic storage area and packed / labelled according to the guidelines of the regional collector. • Maintain log records of all outgoing waste either in terms of weight or volume of jumbo bags and/or containers. The log sheets must be provided to the regional collection supervise or vessel caption. 		
<p>Hazardous Waste Management and Transportation</p>	<p>Do not accept medical hazardous waste as it has to be managed by the island health centre and incinerated separately. Types of hazardous waste managed at the health centre mainly include needles, syringes, expired medicine and contaminated materials (cloth/gauze/disposable gloves).</p> <p>Other types of hazardous wastes generated within the households including small batteries, solvents, paints, used oils, pharmaceuticals and old lights which use mercury shall be managed at the IWRMC.</p> <p>Incoming hazardous waste to the IWRMC should be stored in the hazardous waste storage room in containers or barrels and regularly checked for any leakage.</p> <p>The following measures must be taken during transportation of hazardous waste:</p> <ul style="list-style-type: none"> • Use containers appropriate for the wastes they are intended to carry; • If drums or other containers are used to transport waste, containers should be in good condition and compatible with the waste and are adequately secured in the transport vehicle; • Adequately label all transport tanks and containers to identify the contents, hazards, and actions required in various emergency situations. 	<p>P: Island Council /IWRMC Operator</p>	<p>Cost associated with purchasing containers designed to store hazardous waste and printing of labels.</p>

	 <p>Tampons and nappies, while indicated as hazardous wastes in the ESMP, are biodegradable and can be composted. The high temperature of the composting process has been documented to eradicate any harmful pathogens containing potential biohazards.</p>		
<p>Marine Water Pollution and associated impacts to marine organisms due to potential spillage of waste to the sea during transfer of waste from the IWRMC to the RWMF (loading and unloading)</p>	<p>The IWRMC operators and the island council should ensure implementation of the following measures prior to regional transfer:</p> <ul style="list-style-type: none"> All outgoing waste from the IWRMC shall be stored in bins or jumbo bags and properly labelled to indicate the type of waste. Below are some examples of the signages that can be used to label bins and jumbo bags: 	<p>P: Island Council /IWRMC Operator</p>	<p>Cost associated with printing the labels.</p>

	<ul style="list-style-type: none"> • Maintain log records of all outgoing waste from the IWRMC either in terms of weight or volume of jumbo bags and bins and provide to regional collector. <p>The regional collector should make sure that the following measures are implemented during loading and unloading of waste into the collection vessel (landing craft):</p> <ul style="list-style-type: none"> • Prepare a collection manual that gives instructions related to storage of waste for regional collection and share with the councils. The manual should clearly specify the types of waste that are accepted and not accepted for regional collection, categories to which waste has to be sorted and packaged by the councils (plastics, glass, nappies, metals, hazardous etc.) and any special requirements for packaging waste such as hazardous waste (sealed containers, proper signage etc.). • Prepare a schedule for regional collection and share with the respective councils. In addition to this, it is recommended to inform the exact date of regional collection to the respective council 3 days prior to arrival of the transfer vessel (landing craft). • Properly label the jumbo bags, containers or bins to reflect the type of waste (if this has not been done by the councils). • Record data of all loaded waste in terms of weight or jumbo bags, containers and bins (volume of the bags and bins must be specified). • Waste must not be kept in the open in any circumstance during transfer. • Hazardous waste (such as batteries, paint, thinner, fibre glass etc.) should be kept in the landing craft in sealed containers. The containers should be properly labelled with appropriate signs (for example hazardous, flammable, toxic etc.). Hazardous waste should be kept away from flammable waste such as wood, plastic and paper. • All waste loaded to the transfer vessel should be covered from the top to minimize potential for spillage during transport. 	<p>P: Regional Waste Collator / RWMF Manager / Supervisor / Vessel Captain</p>	<p>Cost of printing manual, posters and billboards</p> <p>Cost of purchasing safety equipment</p> <p>Cost of purchasing whaler</p>
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	<ul style="list-style-type: none"> • The height of loaded waste should not exceed the height of sides of the landing craft. In circumstances where excessive waste is absolutely necessary to be loaded, the sides should be lifted to meet this requirement. • Log records of all unloaded waste (incoming waste to the RWMF) should be recorded either in terms of unloaded weight or volume of bins and jumbo bags for different categories of waste. • Maintaining log records of loaded and unloaded waste quantities are critical and compulsory as it can indicate the amount of waste lost to the sea during transfer (if any). • Give proper instructions and training to the staffs involved in regional collection. • Loading shall be undertaken under the direct supervision of a qualified responsible staff. This staff or supervisor will monitor all activities related to regional collection and transfer and ensure that environmental compliance is achieved. • The waste transfer vessel must be equipped with firefighting equipment and smoke detectors. • The waste transfer vessel should be equipped with navigational safety equipment such as life vests. • The landing craft should be accompanied by a whaler to be used for accessing islands that do not have harbours. 		
<p>Noise pollution during waste management</p>	<p>Depending on availability, battery operated vehicles can be used to provide collection services.</p> <p>Waste handling works involving operation of machinery shall be undertaken during day time.</p>	<p>P: Island Council / IWRMC Operator</p>	<p>Cost associated with purchasing collection vehicles</p>

	<p>Obtain noise data from supplier prior to purchase of machinery.</p> <p>Enclose the noisy machinery with sound insulating enclosure.</p> <p>Reduce duration of exposure by implementing job rotation.</p> <p>Provide employees with hearing protection if required.</p>	S: MCEP (for vehicle and equipment / machinery)	
Air emissions from MSW collection and transport	<p>Emissions from on-road vehicles shall be regulated through national and regional programs.</p> <p>All waste transport vehicles must have up to date road worthiness licenses.</p> <p>Optimize waste collection routes to minimize distance travelled and overall fuel use and emissions.</p> <p>Drivers shall be instructed on the benefits of driving practices which reduce both the risk of accidents and fuel consumption, including measured acceleration and driving within safe speed limits.</p> <p>When the IWRMC and becomes operational no open burning shall be practiced.</p>	<p>P: Island Council / IWRMC Operator</p> <p>S: EPA</p>	Cost of training drivers
Odor Impacts during IWRMC operations	<p>Ensure that stock pile of raw organic waste is kept low and is not left untreated for longer durations.</p> <p>Ensure that staff involved in sorting of received waste and operations of the compost machine are wearing appropriate PPE including masks to mitigate any undesirable impacts of foul smell coming from raw organic waste.</p>	P: Island Council / IWRMC Operator	Cost associated with purchasing PPEs
Amenity Impacts	<p>Ensure that waste is not being kept in the open areas of the IWRMC.</p> <p>Ensure that the composting machine and the other operations of the IWRMC are being carried out daily or in a system manner, in order to avoid creating deposition of huge piles of untreated waste.</p>	P: Island Council / IWRMC Operator	No cost involved

Impacts on Groundwater	<p>Ensure that waste is not being kept in the open areas of the IWRMC.</p> <p>Ensure that the composting machine is being operated daily.</p>	P: Island Council / IWRMC Operator	No cost involved
Waste Generated with the IWRMC during the operational activities	<p>All wastes generated as a direct result of the waste management activities shall enter the waste management stream and managed as prescribed for different waste types; and</p> <p>Prohibit eating/cooking in the IWRMC</p>	P: Island Council / IWRMC Operator	No cost involved
Impacts due to Resource Consumption	<p>It is strongly encouraged to install solar panels on the IWRMC roof to generate required power for the IWRMC.</p> <p>Use solar lights in the premises.</p> <p>Work shall be planned to be carried out during day times.</p> <p>Ensure that the curing system is purchased along with the compost machine.</p> <p>Ensure that stock of bioculum is maintained to cover for a period of 1 year.</p> <p>Ensure that all equipment is serviced and kept clean daily, to reduce the amount of water required for cleaning.</p> <p>Prepare a plan to switch on the compactors and shredders depending on the incoming waste stream to conserve electricity.</p> <p>Make sure all equipment are properly serviced and maintained.</p>	<p>P: Island Council / IWRMC Operator</p> <p>S: MoECCT (for potential Installation of Solar)</p>	<p>Cost associated with purchasing bioculum and servicing equipment.</p> <p>Cost associated with installation of solar panels.</p>
2. Sociological and Cultural			
Occupational Health and Safety Impacts	<p>The IWRMC operator shall be required to develop occupational safety management plan, and safety guidelines shall be displayed in the work site at all times;</p> <ul style="list-style-type: none"> • provide clear instructions to the workers on: <ul style="list-style-type: none"> ○ The possible risks ○ Measures in place to control risks ○ Follow emergency procedures; 	P: Island Council	Cost of purchasing safety materials

	<ul style="list-style-type: none"> • provide proper training including manufacturer’s safety instructions to employees on how to operate machinery; • conduct proper and regular maintenance of machinery used; • prior to maintenance, make sure the equipment is made safe and prevent access to dangerous parts. Make sure others are aware that maintenance is being carried out; • machinery and vehicles should only be handled by employees with the proper credentials and training; and • proper PPE should be provided at work. PPE should be used after all possible risks have been eliminated as much as possible and to manage any remaining risks. • protective clothing, gloves, respiratory face masks and slip-resistant shoes are recommended for waste transport workers and hard-soled safety shoes for all workers to avoid puncture wounds to the feet. • for workers near loud equipment, include noise protection such as ear muffs. • for workers near heavy mobile equipment, and at the discharge location for collection trucks, include provision of hard hats. 		
<p>Fire hazard</p>	<p>Burning of waste at the IWRMC should never be practiced under any circumstances. Naked flames shall not be allowed at the IWRMC.</p> <p>Smoking should be prohibited inside the premise of the IWRMC, placing awareness signs in the premise.</p> <p>Adequate firefighting equipment shall be provided at the IWRMC, and placed at locations easy to access. The current design of the IWRMC includes firefighting equipment.</p> <p>Dispose excessive compost in forested areas, if production exceeds demand and storage capacity.</p> <p>Highly flammable areas such as those area allocated for the storage of paper, wood and cardboards, should be clearly marked with appropriate sign boards indicating the flammable nature of the waste.</p>	<p>P: Island Council</p> <p>S: MCEP (for firefighting equipment and sign boards)</p>	<p>Cost of purchasing equipment</p> <p>Cost of printing and placing sign boards included with the overall project budget.</p> <p>Cost of purchasing cameras, alarms. MVR 10,000.00</p>

	<p>Installation of cameras, fire alarm system and hiring of security guard for 24hrs surveillance.</p> <p>Ensure that waste management staffs are briefed of fire hazard management.</p> <p>Fire safety training on how to use the installed equipment and act in case of an emergency fire should be provided to the security guard and all the waste management staffs of the IWRMC</p>		Salary of security guard (approximately MVR 4000.00 per month)
Sociocultural conflict	<p>Ensure that waste handling staffs are selected from the local community as much as possible. If expatriate workers are used ensure that they respect the local culture.</p> <p>Conduct a training to sensitize the labour to the local context and customs. This training should also cover topics related to Gender-based violence.</p> <p>Develop a “Code of Conduct” outlining the set of rules that that the workers have to follow to persevere the social norms and religious values of the society. The Code of Conduct should also specify penalties for breaching these rules and should be thoroughly communicated to workers prior to mobilization.</p>	P: Island Council	Cost associated with hiring staffs
Grievance Redress Mechanism	<p>The Island Council should device a GRM for the operational phase. The contact details (email and phone number) of the council’s focal point shall be displayed in the IWRMC as well as the council notice board and other public places.</p> <p>If the complaints are not resolved to at Island level, the aggrieved party may submit complaints to the Utility Regulatory Authority (URA) and the EPA.</p>	P: Island Council S: URA / EPA	Cost of printing GRM board and posters
3. Economic			
Collection Fee	<p>Ensure that the collection fees are feasible for the community. Undertake consultation meetings with stakeholders and set a suitable collection fee acceptable to the community.</p>	P: Island Council	Cost associated with conducting stakeholder sessions
Employment Opportunities	<p>Ensure that waste handling staffs are selected from the local community as much as possible.</p>	P: Island Council	Cost associated with hiring staffs

CHAPTER 5 PROJECT ALTERNATIVES

This section explores alternatives for the proposed project. The proposed options are compared with alternatives in detail. When comparing the alternatives, environmental, economic and social considerations were considered.

5.1. No Development Option

In the case of no project option, all foreseeable negative impacts as a result of the construction and operation of the IWRMC can be avoided. However, no project option would also mean continuation of the current state of waste management in the island. The people would continue to engage in unsustainable waste management practices. The island would not have an approved demarcated waste management area, waste would continue to be burned in open areas, and kitchen waste would continue to be dumped on beaches, lagoons and reefs. Allowing existing practices to continue would also mean no resource recovery and ultimately all resources getting lost in the “waste”. Allowing open dumping waste with no management would also mean increasing risks to human health, lowering aesthetic qualities and lowered quality of life. The aspiration of the people to move in the path of sustainable development would also be compromised. The positive effects of proceeding with the project far outweighs negative impacts associated with the project which can be managed and kept at an acceptable level. Hence, no development option of the project is rejected. The table below shows comparison of no development option with the development option at Th. Madifushi.

Table 27 Comparison of the no development option with development option

Option	Environmental	Social	Economic
No Project Alternative	<p>All negative impacts associated with project avoided, however, the island environment may continue to slowly deteriorate due to pollution as a result of inadequate waste management.</p> <p>Land area will be rendered unusable or will be polluted by the residual waste remaining after burning and burying waste. Seepage of leachate into groundwater film as a result of burying waste in excavated pits.</p> <p>Risk of waste piles sliding as a result of heavy rain or flooding events. Increased pollution of beaches, lowered aesthetic values, pollution of the lagoon and coral reef.</p>	<p>Benefit to the society by the project will be missed and chances of polluting the island is high which could lead to health implications as well as visual negative impacts.</p> <p>Risk of waste coming into direct contact with children.</p> <p>Without a proper waste management system there is a risk of the island turning into a slum as a result of population increase and economic development.</p>	<p>No significant improvement to the local and regional economy.</p> <p>Jobs and income earning opportunities expected as a result of the project will not realize.</p>
Project Alternative	<p>The project will result in loss of alternative land use potential for the proposed site</p> <p>All impacts due to construction can be managed and maintained at acceptable level.</p> <p>The project will control and prevent further pollution of the environment, and thereby promote sustainable development of the island.</p>	<p>Increased direct and indirect employment opportunities for the locals during the construction phase in addition to when the IWRMC and waste management system becomes operational.</p> <p>Knowledge transfer and development of technical capacity with regard to waste management and compost making.</p>	<p>Enhanced opportunity for locals to start and diversify tourism related services, since a safe and clean island would facilitate attracting visitors to island.</p> <p>Creation of job opportunities and development of skills.</p> <p>Potential to get income by selling compost etc. which would develop the island's economy.</p>

		<p>More resources and manpower to manage the island would become available as a result of the project.</p> <p>The aesthetic qualities of the island would improve and thereby promote healthy and more enjoyable life on the island.</p> <p>During the operational phase of the project, smell, dust and particulate matter especially from composting activities may be emitted from the IWRMC. However due to the isolated nature of the site to the populated area of the island such impacts are not expected to be significant.</p>	
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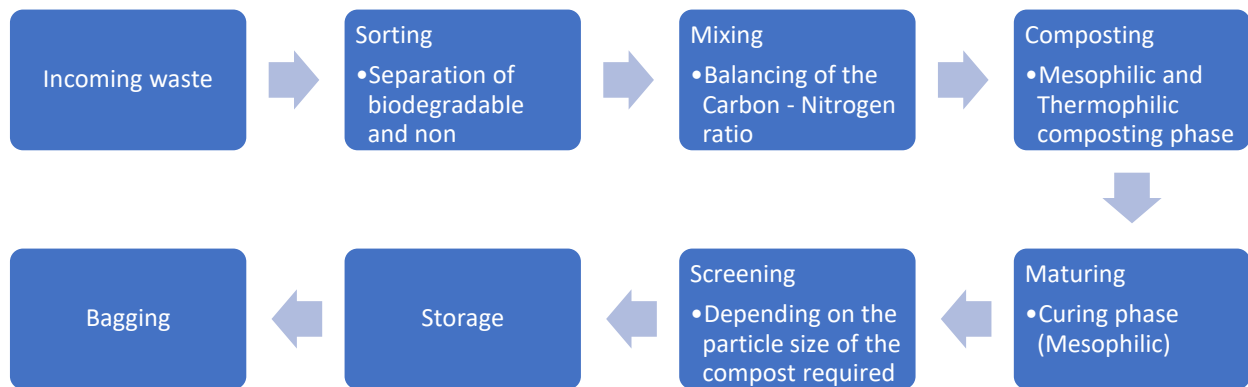
5.2. Alternative technology for treating organic waste

The proposed technology for treating organic waste is in-vessel composting. Alternatives to this could be manual open windrow composting and anaerobic digestion. Each option is discussed separately below.

5.2.1. Manual (Open) Windrow Composting

The main constituents of a compost heap include kitchen and garden waste, along with water and air in the pore spaces between the constituent.

After the incoming waste is properly sorted into compostable wastes and other wastes, mixing of the compostable waste is done. This mixing is done to provide an optimum Carbon-Nitrogen ratio for the process to occur. Prior to mixing, if the waste contains branches, twigs and such, they are fed into a wood chipper to reduce their size. After the mixing is completed, composting process begins on the composting slab as an open windrow compost. After the compost matures, screening is done depending on the particle size of the compost required. This compost is bagged and stored. These steps will be elaborated below.



Thermophilic composting is the process of composting using thermophilic (heat-loving) bacteria. Thermophilic composting consists of three phases;

Table 28 The phases of composting

Stage	Temperature	Duration	Organisms
Mesophilic	Moderate, up to 40 °C	2 days	Initial decomposition is done by mesophilic organisms that thrive at moderate temperatures
Thermophilic	High, over 40 °C	Few days to several months	Mesophilic organisms become less competitive and replaced by thermophilic heat loving microbes. High temperatures break down proteins, fats, and complex carbs like cellulose and hemicellulose (major structural molecules in plants)
Mesophilic (curing or maturation phase)	Moderate, up to 40 °C	Several months	As the compounds decrease, compost temperature gradually decreases and mesophilic organisms take over again for the final curing of the remaining organic matter.

As seen from the **Table 28**, the composting process can prolong to several months.

As the process of composting occurs, leachate will be produced from the organic waste within the compost pile. The composting will be done on the specially constructed compost slab. The bottom of the slab and ground beams in this area have an HDPE membrane between the reinforced concrete and the ground.

5.2.2. Anaerobic Digestion (AD) System - Plug Flow Reactor (PFR) Anaerobic Digester

The Plug Flow Reactor or PFR technology is based on a sealed tank that contains a given quantity of water inoculated with a bacterial component. During the construction and commissioning phase, the water and bacterium inoculum require a 30-day activation period to produce the digester liquid, following which no additional water or inoculum is required as the system is self-sustaining.

With activation and commissioning completed, feeding of waste can be started. The process has a 30-day retention time at the end of which biogas, a digestate and digester liquid are released.

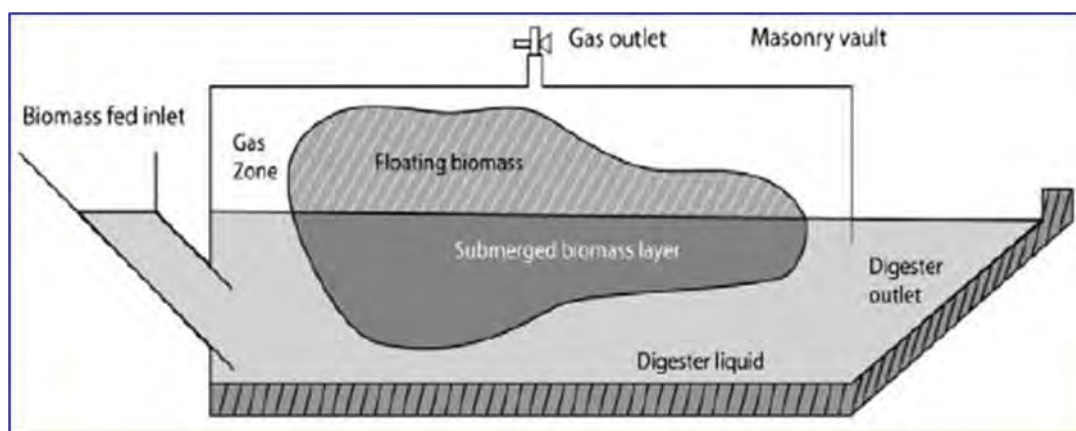


Figure 18 Design of Plug flow type biogas plant

The Plug Flow Reactor (PFR), as shown in the sketch, is a sealed tank that can be constructed from either:

- Fibre Reinforced Plastic (FRP) – with a 20-year life expectancy and guarantee
- Stainless steel – with a 15-year life expectancy and guarantee; or
- Masonry – with a potential 25-year life. (NB: details of the materials used are needed!)

Having been filled with the required quantity of water, the bacterial inoculum is added and the activation is allowed to complete. Waste can then be added through the inlet. The plant can accept food waste and green waste.

If the waste is predominantly food waste, up to 20% green waste can be added. It should be noted that this does not work in reverse.

If the waste stream is mainly green waste, food waste cannot be added so the plant becomes suitable only for 100 % green waste.

Also, because of the bacterial sensitivity, over-feeding of waste can stop the reaction. Thereafter, the unit will need to be re-set, including being cleaned out and a fresh supply of water and bacterial inoculum added, with 30 days to re-activate the process.

It is claimed the system can cope with 15 - 20% non-segregated waste contaminated with glass, plastic and metal (although, it is accepted that metal can destroy the bacteria?).

The system relies on the majority of waste floating within the digester liquid, allowing the bacterial decomposition reaction, thereby liberating the biogas. The system maintains a pH of 6.8 to ensure decomposition. “In BIOEN’s Bio-methanation technology one ton of bio-waste is reduced to less than 100kg in a 30-day retention time.”

Biogas production is claimed at up 60m³/TPD, depending on the particular waste stream.

“Around 5-10% of the biodegradable waste fed into the bio-methanation plant comes out as compost in case of food waste/MSW/cow dung and 30-40% of the material comes out undigested in case of agro-residues.” (NB: this rather contradicts . . . “one ton of bio-waste is reduced to less than 100kg in a 30-day retention time”)

“The agro-residues and leafy material containing lignin does not get digested completely and comes out of the digester at the end of 30-day retention time. This material can be pulled out of the digester and dried to obtain compost of high nutrient value.” (further lessening the reduction? And how long for drying and maturing as compost [NB moving from anaerobic process to aerobic process]?)

From 1TPD of biodegradable waste fed into a biogas plant around 30-40kg of wet compost (6-10kg dry) compost can be achieved. The wet compost has to be extracted from the vessel with the digester liquid and then requires secondary processing under aerobic conditions.

“The digester liquid (600 - 700L/TPD) is also high in nutrients and can be used as fertilizer.” The process assumes that the moisture content of the raw waste feed is sufficient to maintain the liquid level in the reactor vessel (how is this monitored?), thereby allowing digester liquid to be drawn-off for use as a liquid fertiliser.

“The biogas produced can be used directly for cooking or can be converted to electricity. Using our highly efficient IR biogas stoves along with a biogas compressor (2-5Kg/cm²) the biogas can be efficiently used as a substitute for LPG. The excess biogas produced can also be converted to electricity through a biogas generator. For each m³ of biogas generated 1-1.5kW of electricity can be generated.”

It should be noted that not all food waste – eg: bones, egg shells – decompose in the reactor but sink to the bottom and remain there. This necessitates shutting down the system at 3 – 4-year intervals to clean out the reactor and refresh the system, followed by 30-day re-activation.

The reactor has limited flexibility. It can operate at below its rated capacity without damaging the process, but outputs will be reduced, correspondingly. It cannot operate above its rated capacity. At the point at which a small increase in throughput is required, an additional reactor will be required.

5.2.3. Analysis

The table below shows comparison of organic waste treatment options with the proposed in-vessel composting method.

Table 29 Analysis of technology options

Option	Environmental	Social	Economic
Manual (Open) Windrow Composting	<p>Limited process control increases environmental risks such as odour and leachate, which in turn increases the potential for groundwater pollution and occupational health hazards due to odour.</p> <p>Not suitable during rainy seasons as the problem of leachate will escalate, if proper mitigatory measures are not adopted.</p> <p>The materials subject for composting should be turned on a regular basis, taking up to 16 weeks. The compost that is produced must then be graded and screened to remove any remaining contaminants. Thus, longer processing time, increases the duration to which workers are exposed to raw organic waste.</p> <p>Green waste and food waste can be treated mixed.</p> <p>The issues of vectors such as flies and rats exists, which needs to be controlled.</p>	<p>Compared to other processing options, windrow composting has a relatively low throughput per unit surface area, which means demand for land is relatively high.</p> <p>No automatic curing system means that the piles have to be turned manually at least every 5 days. Therefore, the process is highly labour intensive.</p>	<p>Initial investment and operating costs are relatively low.</p> <p>O&M cost is relatively low as no machines or raw materials (bioculum) are required.</p> <p>Indirect economic disadvantage due to high land requirement that may result in high compensation rates.</p> <p>Due to longer processing time, production may not meet demand to realise an economic benefit or to even make return, self-sustaining to operate the IWRMC.</p>
Anaerobic Digestion (AD) System	Energy can be recovered from organic residues in the form of methane rich	Land required for the installation of the anaerobic system is high	The by-product of anaerobic digestion, i.e., digestate, looks as

	<p>biogas, which can be used to generate renewable power and/or heat. Hence, if a bio-generator can be included with the system, the power requirement to operate the IWRMC can be made self-sustainable, which will in turn reduce the reliance on the island power system that uses diesel generators to produce electricity. This will contribute in reducing GHG emissions, although it will be quite insignificant when compared at a national or global scale.</p> <p>Biogas can also be used as a substitute for LPG. But IR biogas stoves and a biogas compressor (2-5Kg/cm²) will be required.</p> <p>The plant allows waste to be fed in partially segregated manner (80 – 90% segregation). Waste can be fed without pulverisation.</p> <p>The potential inclusion of a bio-generator or biogas stoves and compressor increases associated risks such as fire hazards. Additionally, if piping is to be laid to supply gas to restaurants or houses, the risks of leakage from the pipes would exist, thereby increasing the potential for soil and groundwater pollution.</p> <p>Limited potential for treating food waste and</p>	<p>compared to in-vessel composting. Additional land is likely to be required if a bio-generator / IR stoves and a biogas compressor is associated with the system.</p>	<p>a reliable material for agricultural uses.</p> <p>Additional jobs will be created in the operations of the AD plant as well as associated biogas generator and LPG gas supply and distribution systems (if included as a part of the project).</p> <p>This method is the most expensive option out of the three and will require the highest level of technical expertise to operate it properly.</p> <p>Capital investment is extremely high. The plant itself costs around MVR 462,000.00 (USD 30,000.00) excluding civil works, while the inclusion of any associated bio-generator for electricity production or IR biogas stoves and compressor for LPG gas production will escalate the capital investment even further.</p> <p>Can assist to make the IWRMC self-sustainable, if associated with a bio-generator or IR biogas stoves and compressor.</p> <p>The O&M cost is high. The system is complex</p>
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	green waste mixed. Only 20% of green waste can be added if food waste is the majority to be treated.		to operate and requires high level of technical expertise and training. An adequate stock of inoculum needs to be kept.
In-vessel Composting (Proposed Method)	<p>No odour and very little leachate are produced.</p> <p>High potential for treating both food waste and green waste in mixed form. It can convert organic waste such as kitchen waste, garden waste, food processing waste etc. into compost.</p> <p>Remove the problem of vectors such as flies and rats.</p> <p>Electricity is required for the operations of the composting machine, which contributes indirectly to the release of greenhouses gases and greenhouse effect, if power is sourced from the island powerhouse as proposed. However, the contrition is quite insignificant when compared nationally and internationally.</p>	<p>Requires significantly less land and manual labour than windrow composting and AD systems, as it comes with automatic curing system, which maintain perfect moisture and keep track of the compost as it cures.</p> <p>Land requirement for the machine including the curing system is very low compared to both the AD system and the open windrow composting method.</p>	<p>This method is more expensive than open windrow composting, but significantly less expensive than the AD system. The price of the proposed system is approximately MVR 55,000.00 (USD 3,500.00) excluding accessories and shipping cost.</p> <p>It is extremely simple to operate and requires minimal training and is not as complex as the AD system.</p> <p>The O&M cost is slightly higher than open windrow composting as an adequate stock of bioculum and absorbents needs to be kept. However, only 1g of bioculum has to be added per kg of waste fed, coupled with 2 kg of absorbent (if required) per each batch treated. Hence, as per the rate of organic waste generation in Madifushi (1004 kg per day) only 1g of bioculum per day equal to 30g per month</p>

			<p>and 361g per year is required for the operations. According to the current market price, a 1kg packet of bioculum costs roughly MVR 50 (USD 3), which would suffice for a yearly treatment of organic waste in Madifushi.</p> <p>Increased market potential, due to shortened production time (10 – 12 days) and the quality of the compost. The quality of compost produced meets stringent international standards.</p> <p>It can treat upto 100 - 3000 KG of waste /day, which has to be then put in the curing system for 10-12 days.</p>
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Based on the above discussed options, the proposed method of in-vessel composting is determined as the most viable option for treating organic waste generated in Madifushi, due to it being the least labour intensive, most economically feasible and least harmful to the environment.

Although certain environmental benefits are envisaged for the AD system option, such as its potential to utilise the bio-gas for electricity generation or LPG gas production, thereby indirectly contributing to reduce GHG emissions and global warming, its associated risks such as increased potential for fire and groundwater / soil pollution diminishes this benefit. Moreover, such benefits can only be realised if the required accessories are included as part of the system / the project, whereas this option will not be viable and would be considered as a wastage of resources, if the system does not come equipped with a way to utilise the bio-gas generated, while instead the gas is only flared. The high capital investment and O&M cost compounds the viability of this options even further from an economic perspective, while the large land requirement to establish the system and its associated systems can potentially cause negative social impacts.

The open windrow composting method is the least favourable option out of the 3 options proposed, as it has the highest negative environmental and social impacts. Although this option has the lowest capital

and O&M cost, it has the least potential for generating a profit or making the IWRMC self-sustainable, due to comparatively low quality of the compost produced and the high production time. This option is also highly labour intensive, where the piles have to be turned manually at least every 5 days.

5.2.4. Mitigation Measures for Alternative Organic Waste Treatment Options

The current proposed in-vessel composting technology should only be changed to AD systems or open windrow composting subject to full implementation of the following proposed mitigation measures.

a) Manual Open Windrow Composting

- The composting shall be done on a specially constructed compost slab. The bottom of the slab and ground beams in this area should have an HDPE membrane between the reinforced concrete and the ground.
- Adequate provisions need to be made for leachate collection and treatment / disposal. Leachate collection tanks should be constructed.
- Regular turning the piles should be practiced, as it can help minimise the quantity of leachate produced.
- The piles should be kept well aerated, which promotes free airspace and results in aerobic respiration. However, if sulfur-containing materials are composted, it is advisable to minimise the amount of water added to compost (e.g., by covering compost material), so as to avoid anaerobic conditions that can cause hydrogen sulfide odours.
- The leachate collected shall be reused to provide moisture to the compost heaps.
- Windrow covers should be used during raining seasons. Alternatively, the compost pad can be partially covered with a roof so the piles can be moved to the shaded area during rainy season.
- In rainy seasons, the shapes of the pile can also be adjusted so that water runs off the top of the pile rather than being absorbed into the pile.
- Design and maintain the slope and orientation of windrows and/or leachate drains such that free drainage of leachate to a collection tank is facilitated and ponding of leachate is avoided.
- Turning equipment should be purchased as part of the project and used to turn the piles to reduce manual labour.
- A manual compost rotatory screen is recommended to be purchased.
- Carbon: Nitrogen (C:N) ratio shall be maintained between 25:1 and 35:1.
- pH should be maintained between 6 and 8.
- Avoid conditions that can lead to spontaneous combustion (e.g., moisture between 25 – 45 percent and temperatures above about 93°C. This can be achieved for example by keeping windrows less than about 3m high and turning them when the temperature exceeds 60°C).
- Consult the public and the Island Council regarding the change in scope of the project.
- Provide adequate training to the operators.

b) Anaerobic Digestion (AD) System

- Acquire land approval from the Maldives Land and Survey Authority, if additional land area is required for the civil works of the AD plant.
- If vegetation belonging to any individual falls in the additional land, compensation needs to be given prior to commencement of civil works.
- 2:1 replantation must be carried out for each vegetation removed from the additional land (if required).
- Consult the public and the Island Council regarding the change in scope of the project.
- Ensure that a mechanism is included to utilise the biogas generated.
- Provide a fire alarm system, including temperature sensors in the waste being treated. Ensure fire-alarm systems and firefighting equipment are installed at/or close to the AD plant and associated equipment or facilities.
- If biogas is to be utilised for cooking, bottling method should be adopted instead of laying pipes to supply gas. Flammable hazard signs shall be installed at the gas bottles.
- Adequate training should be provided in the operations of the AD plant, bio-generator or gas extraction and bottling.
- Maximize recycling of wastewater to the reactor.
- Measure total organic carbon (TOC), chemical oxygen demand (COD), nitrogen (N), phosphorus (P) and chlorine (Cl) levels in the inlet and outlet flows from an anaerobic digester. When a better control of the process is required, or a better quality of the waste output, monitoring of additional parameters may be necessary.
- Operate the anaerobic digester under thermophilic digestion conditions, in order to increase the pathogen destruction, biogas production rate (hence higher energy recovery) and the retention time
- Emissions from digestate storage should be minimized since they are one of the major sources. Either the digestate tank should be covered (gas tight with gas utilisation) or the degradation of the substrate should minimize the possibility of emissions.
- Any aerobic post-treatment should include a sufficient oxygen supply in order to avoid methanogenic activity. The monitoring of oxygen supply (or methanogenic activity) within the process is recommended.
- The biogas containing components should be frequently monitored to identify leakages. This could include surveys with leakage detection systems such as methane cameras and handheld lasers. Such a survey is recommended to be carried out every 1 to 3 years, depending on the status (age and number of leaks found) of the plant. Monitoring for elevated methane concentrations within the off-gas streams from air inflated double membrane roofs should also be included in routine measures.
- Plant management should aim at avoidance of PRV releases (and flaring events) in order to minimize emissions and losses in general.
- Pressure and vacuum relief valves with flame arresters should be installed on digester covers. When foam clogs the flame arresters, it may prevent the pressure and vacuum relief valves from

properly relieving pressure or vacuum accumulation which could cause damage to the digester and the digester roof.

- Emergency pressure or vacuum relief can be accomplished by installing emergency relief valves. Installing a foam separator immediately downstream of the digester will prevent foam from entering downstream of the digester.
- Flame arresters is recommended be installed between ignition sources and vital equipment. In addition, thermal shut-off valves should be used along with all in-line arresters. Flame arresters should be installed along with all pressure and vacuum relief valves on the digester roof to prevent external flames from igniting gas inside the tank.
- Provide adequate training to the operators in terms of operating the machine as well as maintenance and repair.
- Always keep one-year stock of spare parts.

5.3. Alternative Energy Sources

The proposed method for supplying electricity to the IWRMC is through the island power grid by laying a cable from the nearest distribution box to the IWRMC main electricity board. Alternative options are discussed in terms of installing a solar PV system and a diesel generator.

5.3.1. Analysis

Table 30 Analysis of alternative energy options

Option	Environmental	Social	Economic
Solar PV system	<p>Emissions from fossil fuel burning will be completely avoided, thereby contributing to minimise GHG emissions and assist in the works to make the country carbon neutral.</p> <p>Potential for groundwater / soil contamination due to oil spillage during fuel transport and storage will not exist.</p>	<p>Additional land is not required for installing solar PV as the roof area of the IWRMC will be utilised and is more than sufficient.</p> <p>The entire roof area of the IWRMC (corresponding to about 80% of the centre) is not likely to be required for the installation of a solar PV system to supply electricity to cater for the operational requirements of the centre. Hence, the remaining roof area of the IWRMC can potentially be utilised</p>	<p>High capital investment (5-10 times higher than a diesel generator), but very low running cost. Washing the panels, replacing the inverter and some standard electrical maintenance is generally all that is required.</p> <p>High durability with a lifetime of 20 – 25 years. Output decreasing to around 80% of the original yield after this time. The reason for this longevity is that solar panels have no moving parts. It is only the slow</p>

		<p>for future expansion of the solar PV system to supply electricity to wider community.</p> <p>Excessive electricity generated through solar can be supplied to the island power grid which in turn can contribute to reduce the cost of electricity and electricity bills.</p> <p>Risk of potential accidents during handling of flammable liquid that may result in occupational health hazards and property damage (to the infrastructure and equipment) will be avoided.</p> <p>The surface of solar PV is smooth and reflective and can reflect light the neighbouring building based on the tilt of the panel and time of day. If such a reflection affects nearby buildings and neighbours it is likely to become a source of grievance.</p>	<p>degrading effects of UV that wear the panels down.</p>
<p>Installing a Diesel Generator within the IWRMC</p>	<p>Fossil fuel combustion releases GHGs to the atmosphere, which contributes to global warming.</p> <p>Burning fossil fuels emits a number of air pollutants such as SO₂, NO_x, and</p>	<p>Additional space is required for the installation and operations of the generator, which ultimately takes up land that can otherwise be reserved for future</p>	<p>Low initial cost than solar, but higher than establishing a connection from the island power grid. However, an additional building (a power house) will have to be incorporated into the</p>

	<p>particulate matter that are harmful to both environment and the public health.</p> <p>There is potential for groundwater / soil contamination due to oil spillage during fuel transport and storage.</p> <p>Air filters, flue gas cleaning system and emission monitoring system needs to be installed, to meet the requirements of the international and local standards.</p>	<p>needs of the community.</p> <p>Occupation health risks and property damage associated with improper handling of fuel will exist.</p> <p>Indirect benefits to the community through reduction in the cost of energy bills cannot be realised.</p> <p>Public health implications associated with burning of fossil fuels will exist especially if proper filtration and emission control systems are not being installed.</p> <p>SO₂ emissions can exacerbate respiratory ailments, including asthma, nasal congestion, and pulmonary inflammation.</p> <p>NO_x emissions led acid rains can result in burning of lung tissue and making people more susceptible to asthma, bronchitis, and other chronic respiratory diseases.</p> <p>Particulate matter (soot) emissions produce haze and can cause chronic bronchitis, aggravated asthma, and elevated occurrence of</p>	<p>design, which will in turn increase the overall cost of civil works.</p> <p>Constant running cost due to the need for fuel, cleaning and filter changes.</p> <p>Diesel generators are unreliable and often require expensive overhauls to be repaired.</p> <p>Long term cost is more expensive than solar.</p>
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		premature death, while is also known to cause heart attacks.	
Connection from Island Power House (proposed method)			
	<p>Environmental impacts associated with fossil fuel burning such as release of harmful gases to atmosphere, contributing to global warming, would still exist as an indirect impact since diesel generators are used in the island power house. However, this impact would not be localised, in contrast to installing a separate generator for the IWRMC.</p> <p>Potential for groundwater / soil contamination due to oil spillage during fuel transport and storage will be minimised, since diesel generators and fuel storage will not be included as part of the project.</p> <p>Damage to the power house generators can compromise the operations of the IWRMC, which may result in the increase in littering and dumping of waste to unassigned areas, if the generators have to be shut down for longer durations.</p>	<p>Additional space will not be required.</p> <p>Occupational health and safety risk associated with handling and transportation of fuel will be avoided.</p> <p>Would indirectly contribute to public health implications associated with fossil fuel burning. However, it will reduce the percentage of community being exposed to such gases, as emissions would not happen on two different locations, but would rather be confined to the area close to the power houses.</p> <p>Indirect benefits to the community through reduction in the cost of energy bills cannot be realised.</p>	<p>Low capital cost and no operational cost.</p> <p>Moderate indirect running cost, as electricity bills would need to be paid to FENAKA on a monthly basis.</p>

Based on the above discussed options, the proposed option of establishing a connection from the local power houses is determined as the most feasible option, due to the low capital cost involved and the potential for keeping environmental and social impacts minimised, in comparison to installing a sperate diesel generator in the IWRMC. However, a solar PV system is found to be the most beneficial since significant positive environmental and social impacts are envisaged, while it would result in cost savings

in the longer run. Hence, if the initial investment cost can be covered through the project, it is recommended to adopt this option.

5.3.2. Mitigation Measures for Alternative Energy Sources

a) Solar PV System

- Minimize the tilt of the solar PV slope to rectify the potential issue of light reflection. This could be further enhanced by installing screen, although no major impacts are envisaged as the nearest residential house is 134 m away from the site.
- Establish mechanism to supply excessive electricity to the island power grid.
- Make the remaining roof areas accessible for future investments to expand the solar PV system that could potentially service a wider community.

b) Installation of a diesel generator within the IWRMC

Social Measures

- Acquire land approval from the Maldives Land and Survey Authority, if additional land area is required for the civil works of generator installation.
- If vegetation belonging to any individual falls in the additional land, compensation needs to be given prior to commencement of civil works.
- 2:1 replantation must be carried out for each vegetation removed from the additional land (if required).
- Consult the public and the Island Council regarding the change in scope of the project.

Emission Control

- Air filters, flue gas cleaning system and emission monitoring system should be installed, to meet the requirements of the international and local standards.
- The exhaust pipe should be fitted with filters and according to Maldives Energy Authority (MEA) standards.
- The generator exhaust must discharge vertically for maximum dispersion modelling.
- The rain cap shall fully open without impeding the vertical discharge while the generator is operating.
- Design the stack heights according to Good International Industry Practice (GIIP) to avoid excessive ground level concentrations and minimize impacts, including acid deposition. The stack height should be raised above the canopy of the island
- Ensure the exhaust is clear of trees, combustible materials and pedestrian traffic to avoid fires and burn hazards.
- Use fuels with a lower content of sulfur where economically feasible. Use the cleanest fuel economically available (natural gas is preferable to oil, which is preferable to coal).

Noise

- The power house building should be made sound proof.
- Restrict working hours to day time where possible.
- Generator operators should wear noise cancelling headphones.

Operational Health and Safety

- Acquire additional PPEs required for the generator operators and ensure that at least a month's stock is maintained in advance.

Spill Control / Fuel Storage / Fire Prevention

- Generator locations must be equipped with a spill kit, which must be inspected at least annually and after use. The spill kit must be housed in an area that is in near proximity to the generator and protected from the weather.
- Fuel shall be stored in appropriate containers/ storage tanks such as syntax HBP tanks, metal storage tanks, metal barrels and plastic barrels.
- The fuel storage tanks shall be properly banded in a concrete chamber to prevent oil leachate into the soil and groundwater in case of leakage or oil spills.
- The main switch of the storage room shall be installed outside the room.
- The cleanliness of the storage room shall be strictly maintained.
- If there are more than 1 storage tank, a gap of at least 1 m between the storage tanks shall be maintained;
- There shall be enough space between the bund wall and the storage tank to allow for pressure release and the tank shall be designed with auto pressure release systems in case of fire.
- Containers shall be tested at least once every 5 years, on suspicion of leakage or after every maintenance. These tests shall only be done by technical experts only after making the containers gas free and in accordance with the NFPA 30 "Flammable and Combustible Liquid Code.
- Fuel storage rooms as well as engine rooms and control room shall be installed with an appropriate number of fire extinguishers as per section 4 of article 4 of the fuel use, storage and handling regulation of the Maldives.
- At least 2 DCP fire extinguishers of 9 kg shall be located near fuel storage areas and be of a suitable type and size to permit the evacuation of workers during a fire.
- Smoking shall not be permitted in the area of the fuel storage tank and "NO SMOKING" signs in both English and local script shall be posted. Smoking shall not be permitted during any fuelling operation. "No Smoking" signs are to be maintained in good condition.
- In addition to no smoking signs, the storage tanks shall have the following signs posted both in English and local script:
 - i. NO NAKED LIGHTS
 - ii. FLAMMABLE LIQUID
- Waste oils, lubricants, greasy or oily rags, or any other materials subject to spontaneous combustion shall be retained in a labelled container used for that purpose exclusively and shall be disposed of at frequent intervals to a RWMF, until then, they shall be stored safely in appropriate containers, for e.g., metal barrel.

- Containers shall be tested at least once every 5 years, on suspicion of leakage or after every maintenance. These tests shall only be done by technical experts only after making the containers gas free and in accordance with the NFPA 30 “Flammable and Combustible Liquid Code”.
- The area shall be bonded in accordance with the NFPA 780 “Lightning Protection Code”;
- Wiring near the storage tanks shall comply with the standards of Maldives Electricity Bureau, in addition, the wiring shall be enclosed with conduit pipes. Lightings, switches and plugs installed shall be flame proof.
- Storage tanks of 3000 L or more shall be installed with automatic foam sprayer systems as well as automatic drencher systems.

Operations and Maintenance

- Provide adequate training to the generator operators in terms of operating the generator as well as maintenance and repair.
- Always keep one-year stock of spare parts.
- Undertake regular maintenance and servicing of the generator.

CHAPTER 6 MONITORING AND REPORTING

6.1. Scope

This chapter would present in detail the management measures put in place by the Proponent and the contractor to mitigate the environmental and social impacts that would arise from the project activities. The assessment of impacts and mitigation measures that would be put in place had been discussed in detail in the previous chapter. The main scope or objectives of the Environmental and Social Management Plan are to:

- a) Produce a framework for anticipated impacts, including practicable and achievable performance requirements and systems for monitoring, reporting and implementing corrective actions during pre-construction, construction and operational phase; and
- b) Provide evidence of conformity to laws and regulations and requirements of enforcement agencies.

6.2. Environmental Management System

The environmental management framework for the proposed project is based on the standards and policies set out by the Environmental Protection Agency of the Maldives under EIA Regulation 2012, as well as the ESAMF by MCEP.

- a) Environmental Management Planning and establishment of key performance indicators: The ESMP specifies environmental management measures and required performance standards;
- b) IWRMC construction and operations: The aspects of the construction and operation will be established and operated according with the ESMP;
- c) Monitoring and corrective action: The implementation of ESMP measures will be monitored during operational stage and will be reported. Any inconsistencies between the ESMP and its on-site implementation will be identified and addressed through corrective actions; and
- d) Auditing, reviews and enhancement: The ESMP will be reviewed. Improvements to the ESMP will be made as necessary to achieve desired environmental outcomes.

6.3. Environmental Management Structure

This Sections detail the various parties involved in the implementation of the environmental plan and their responsibilities.

a) The Proponent, Ministry of Environment, Climate Change and Technology

ME will be responsible for the execution of the project activities within the required timeframe. ME is also responsible of policy level decisions and provision of support regarding the waste management works undergone in the island as well as the regional level. ME will also be responsible for leading the discussions with the Island Council and other relevant organisations on capacity development, training and facilitating

resource acquisition for the sustainable management of the IWRMC. In addition, ME will be responsible for the following:

- Environmental monitoring according to the proposed framework; and
- Management of grievances received at tier 2 (those that are not resolved at tier 1 by the Island Council). See **Table 37** for details.

b) Island Council

During the construction phase the Island Council will be primarily responsible for the following:

- Facilitating all activities related to the Project at island level;
- Implementation of the Island Waste Management Plan (IWMP) for a period of 5 years.
- Implementation waste Management Regulations for the island;
- Implementation of Waste Management Guidelines for the island; and
- Overseeing the operations of the IWRMC.
- The Island Council is responsible to ensure the progress of the Island Waste Management Plan and achievement of the set goals through implementing the plan. The island council is also responsible for the compilation of the IWRMC reports submitted by the occupier as well as producing an IWRMC monitoring report as well as reporting of public grievances. These reports shall be submitted to the MEE bi-annually for review. This also includes management of grievances at tier 1. See **Table** for details.

c) The Contractor

The contractor will undertake the project in accordance with the ESMP and will report to the Proponent and environment consultant about any unexpected environmental impact or health and hazard issues. During the construction stages, the contractor will follow all mitigation and management measures proposed in the report, mainly waste management, pollution control, accident prevention and work methodology proposed. The contractor will submit monthly ESMP monitoring reports to the PMU during the construction period.

d) Environmental Consultant

The environmental consultant would prepare the ESMP based on field visits and surveys and based on past project experiences in similar settings. If there are any modifications to be made to the ESMP during any stages of the project, the consultant would do the modification. The consultant for this ESMP is the ESS Specialist of MCEP.

e) Environmental Protection Agency

The Environmental Protection Agency would review the monitoring reports submitted by the Proponent and would continue with regulatory monitoring visits to the project site upon their needs.

f) IWRMC Operator

The IWRMC operator will be responsible in running the operations in accordance with the guidelines set by this ESMP and the approved IWMP of Madifushi Council. The responsibilities of the IWRMC operator include producing the IWRMC operations reports and submitting the reports to the Island Council at the proposed regularities.

6.4. Reporting Procedures

The reporting procedures presented in **Table 31** have been developed in order to ensure that the proponent is able to receive feedback from the implementation of the ESMP on an ongoing basis and to take rapid corrective actions if there are issues of non-conformance.

Table 31 Reporting Procedures

Phase	Responsibility	Deliverables	Accountability
Construction	Contractor	<p>Monthly monitoring progress reports (3 to 6) prepared consistent to the template provide by the Safeguards Specialist of MCEP.</p> <p>These reports should indicate the level of implementation of mitigation measures and must be accompanied by photographic evidence.</p>	<p>Contractor. To be attached with interim payment claims made by the contractor.</p> <p>Payments to be released subject to timely submission of the monitoring reports.</p>
	APCs	Two (2) interim reports prepared consistent to the template provide by the Safeguards Specialist of MCEP. Verification of accuracy of the monthly progress reports submitted by the contractors.	MCEP / ME APC should submit report to Safeguards Specialist for review and verification.
Completion of construction and demobilization of contractor from site	Safeguards Specialist	Final monitoring report including all monitoring activities throughout project implementation.	MCEP. Report to be submitted to the World Bank and EPA.
6 months after commencement of operations	Island Council	Operational phase monitoring report including activities implemented during operations of the IWRMC.	Island Council. Report to be submitted to EPA.

6.5. Implementation schedule

The activities related to environmental management and monitoring have to be integrated in the overall construction schedule. The project implementation phase is estimated to be completed in 6 months. The implementation schedule is presented in **Table 32**.

Table 32 Tentative ESMP Implementation Schedule

#	Activity Description	Responsible	Preconstruction (Week)						Construction (Months)						Operation (Months)						
			1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6	
1	Clearance and formal disclosure of ESMP	MCEP	■	■	■	■															
2	Inclusion of ESMP in bid document	MCEP	■																		
3	Finalization of Engineering Designs	MCEP	■																		
4	Inclusion of ESMP in the contract document	MCEP						■													
5	Disclosure of GRM in project sites	MCEP Island Council						■													
6	ESMP briefing to Contractor at kick-off meeting	MCEP						■													
7	Contractor's ESMP monitoring reports	Contractor								■	■	■	■	■	■						
8	Compliance check / Interim monitoring reports (2 nos)	MCEP									■					■					
9	Preparation and submission of consolidated monitoring report	MCEP															■				
10	Preparation and submission of operational phase ESMP report	Island Council																			■

6.6. Contractual measures

Implementing the mitigation measures are an obligation of the contractor during the construction phase of the project. The EPA and World Bank approved ESMP should form part of the contract and the mitigation matrix shall be extracted from the ESMP and reflected as an appendix to the contract. In addition to this, the following clauses should be incorporated in to the contract document of the selected contractor as condition of the contract to ensure effective, timely and stringent implementation of the ESMP.

1. Retention payment will be released after defects are rectified and compensating for any significant environmental and social safeguards violations.

2. Payment claims made by the Contractor should be accompanied by progress reports that reflect works completed and Environmental and Social mitigation measures implemented. Payments will only be released after verifying the authenticity of these reports.
3. The Employer or the Contractor may terminate the Contract if the other party causes a fundamental breach of the Contract. Fundamental breaches of Contract shall include, but shall not be limited to, the following:
 - If the Contractor fails to implement the mitigation measures proposed in the ESMP of the project.
 - If the Contractor fails to submit staff list and valid work permits of the expatriate staffs within 10 days of signing the agreement.

6.7. Cost estimate for ESMP implementation

To effectively implement the mitigation and monitoring measures recommended in this ESMP, necessary provision will have to be made. The cost of these measures has been estimated in consultation with the Civil Engineer and Project Coordinator of MCEP, separately for construction and operational phase and presented in **Table 33** and **Table 34**. The BOQ will reflect the items specified in **Table 33** and the bidders should consider these costs while preparing bid documents. The overall project budget should consider the cost estimates presented in both the tables. The total estimated cost for the ESMP implementation is MVR 68,200.00 for construction phase and MVR 1,237,500.00 for operational phase.

Table 33 Estimated Cost for ESMP implementation during Construction Phase

#	Item	Responsibility	Cost Estimate (MVR)
1	PPEs required for construction such as hard hats, gloves, safety shoes and safety harness.	Contractor	10,000.00
2	PPEs to mitigate COVID19 such as face masks, antibacterial soap, hand sanitizers, disinfectant cleaning liquid (bleach) and printing of awareness materials etc.	Contractor	5,000.00
3	Portable fire extinguisher for site	Contractor	2,000.00
4	Firefighting Equipment for the IWRMC (item included in BOQ): <ul style="list-style-type: none"> • 50KG DCP Trolley (nos 2) • 50LTR Foam Trolley (nos 1) • Wet Chemical 6Ltr with Cabinet for hazardous waste area (nos 1) • Water 9Ltr with Cabinet for Office Area – Outside (nos 1) • CO2 2KG with Cabinet for Office Area – Outside (nos 1) 	Contractor	35,000.00
5	Project board and Construction Safety sign board	Contractor	3,000.00
6	IWRMC name board, cell labels and fire safety sign boards	Contractor	5,000.00
7	Bin for placing general waste	Contractor	1000.00
8	Site demarcation through hoarding	Contractor	1000.00

	Subtotal		62,000.00
	Contingency	10% of Sub-Total	6,200.00
	Total		68,200.00

Table 34 Estimated Cost for ESMP implementation during Operational Phase

#	Item	Responsibility	Cost Estimate (MVR)
1	Composting Machine and Curing System	MCEP / ME	500,000.00
2	Glass crusher, metal can baler, plastic shredder and wood chipper	MCEP / ME	500,000.00
3	PPEs required for operations such as gloves, safety shoes and masks.	Island Council	10,000.00
4	Fire safety Training	Island Council	10,000.00
5	Yearly servicing of the firefighting equipment	Island Council	5,000.00
6	Community Mobilization and Awareness	MCEP	100,000.00
	Subtotal		1,125,000.00
	Contingency	10% of Sub-Total	112,500.00
	Total		1,237,500.00

6.8. Environmental and social monitoring plan

The Environmental and Social Monitoring Plan has the following objectives;

- To ensure that the environmental and social mitigation and enhancement schemes, are well understood and communicated to all involved parties.
- To evaluate the effectiveness of environmental and social remedial measures and procedures.
- To evaluate if the intended benefit of the project is realised

The intended positive impacts of the project can only be accurately determined by the post-project monitoring scheme. In order to ensure effectiveness of the proposed project it is essential to monitor, collect information, evaluate the information collected and information disseminated. The monitoring plan for the ESMP is presented in **Table 35**. Monitoring results shall be documented with preventive/corrective actions to be implemented.

Table 35 Environmental and Social Monitoring Plan

Aspect	Parameter	Frequency	Responsible Party	Cost of Monitoring (MVR)
Construction Phase				
Implementation of mitigation measures during construction	Records of successful implementation of mitigation measures	Monthly during construction period	Contractor MCEP	18,000 cost of traveling to the island
Groundwater Quality	Visual observations and perceptions of nearby residents. Salinity, smell, colour of water of the groundwater well within the IWRMC	Twice during construction phase	Contractor MCEP	9,000 Cost of traveling to the island
Grievance	Log records of number of complaints received and actions taken during construction phase	Throughout the construction phase	Island Council MCEP	9,000
Operational Phase				
Implementation of mitigation measures during operations of the IWRMCs	Records of successful implementation of mitigation measures.	6 months after commencement of operations	Island Council / IWRMC Operator	Included in Operational Cost
Spillage Assessment	Waste Collection Arrangements Littering around the island (Beach, harbor area and other public areas) Spillage during transfer to IWRMC Any Spillage within the IWRMC Proper use of IWRMC Spillage during transfer to regional waste facility	Once when the project is completed and one year after project completion	Island Council / IWRMC Operator RWMF Operator	Included in Operational Cost

Groundwater Quality	Visual observations and perceptions of nearby residents. Salinity, smell, colour of water of the groundwater well within the IWRMC.	6 months after commencement of operations	Island Council, IWRMC Operator	Included in Operational Cost
Grievance	Log records of number of complaints received and actions taken during operational phase	Throughout the operational phase	Island Council	Included in Operational Cost

6.8.1. Monitoring Report

Reporting will be carried out by the ESS Specialist assigned for the purpose by the Proponent.

The report will include among other information;

- Details of what was being monitored;
- Methodology of data collection and data analysis;
- Major findings;
- Effectiveness of the mitigation measures in place and
- Recommendations and conclusions.

A detailed environmental monitoring and management report is required to be compiled and submitted to the EPA. In addition to this, regular site monitoring would be carried out by the Proponent that requires maintaining logs of events as explained in this report. Enforcement officers from EPA may also visit the site for inspection from time to time.

6.9. Monitoring Report Format

The structure of environmental monitoring report is presented below.

Table 36 Monitoring report format

Project Title:
Name of the Island:
Monitoring Date:
Period Covered:
Prepared by:
Contributions:
A. Introduction <i>Give a brief introduction about the project and the monitoring carried out</i>
B. Methodology <i>Brief detail of the methodology applied for undertaking the monitoring assessment</i>
C. Environmental Monitoring a. Groundwater quality <i>Parameters given in the monitoring plan need to be assessed</i>
b. Waste generation and management at IWRMC <i>These include monitoring for pests and diseases as described.</i>
D. Risks and Mitigations <i>Please indicate any critical unresolved risks that affect the course of the system operation, analyse the cause, assessing the potential impacts on the environment providing the proposed mitigation strategy</i>
E. Problems Encountered <i>Indicate any problem areas encountered and any corrective measures that will have to be taken.</i>
F. Recommendations and Adaptations as Solution <i>If specific recommendation is noted during the monitoring phase, specify it in the report</i>
G. Conclusions
Reference
Appendix

6.10. Grievance Redress Mechanism

Based on the ESAMF, MCEP has formulated a Grievance Redress Mechanism (GRM). GRM is established to receive and facilitate grievances of the affected persons during the implementation of the project.

Madifushi Council was briefed about the GRM during consultations held on 4th April 2023. The council has nominated Mohamed Shinaan (P: 7926566 E: info@madifushi.gov.mv) - Economic Development Officer as the focal point for managing tier 1 grievances. The council has also agreed to display GRM information in the council notice board as well as in community Viber and WhatsApp groups in digital format. Furthermore, relevant information about the GRM was also provided to the contractor.

GRM at tier 2 will be managed by the Environmental and Social Safeguards Specialist of MCEP (P: 3018446, E: mcep@environment.gov.mv), while Sexual Exploitation and Abuse (SEA) / Sexual Harassment (SH) / Gender Based Violence (GBV) related incidents are to be reported directly to Family and Children Protection Centre of Thaa Atoll functioning under Ministry of Gender, Family and Social Services (P: 3027645 / E: th.fcsc@gender.gov.mv). Any such cases that may get raised at tier 1 or tier 2 of the GRM should also be passed to the national service provider. The Island Council and MCEP should maintain confidentiality in handling and reporting such cases.

Contact details of the contractor's site supervisor, along with Island Council and the MCEP focal points and Family and Children Protection Centre of Thaa Atoll will be displayed in the project site and public places. QR code providing access to the digital complaint form will also be shared with the GRM information. Furthermore, a live sheet for recording grievances will be created and shared with all the focal points. This common sheet will be used to record grievances received and actions taken at all tiers, which will assist to keep track.

Following are the details of the GRM developed by the MCEP.

English page:

<http://www.environment.gov.mv/v2/en/download/7189>

Dhivehi page:

<http://www.environment.gov.mv/v2/dv/download/7191>

Digital Complaint Form:

<https://ee.kobotoolbox.org/x/O5kHJPu2>

Table 37 Details of the Grievance Redress Mechanism developed by the MCEP

Tiers of Grievance Mechanism	Nodal Person for Contact	Contact Communication and other facilitation by the project	Timeframe to address grievance
<p>First Tier: Island Council</p>	<p>Island Council will be the first point of contact for any grievances.</p> <p>The staff designated as the waste management focal point by the island council will manage grievances on behalf of the council.</p>	<p>GRM should be publicly displayed in the construction site as well as the council office. GRM should also be outlined in official website and/or social media pages of Council, MEE (and/or the project), including contact details of the nodal person in each tier.</p> <p>Grievances can be addressed informally by contacting the council through email / telephone / in person.</p> <p>If the grievance cannot be resolved informally, an aggrieved party must submit a complaint on the Tier I Complaint Form. A copy of the form (with the council seal) should be provided to the aggrieved party as evidence of receipt.</p> <p>Electronic version of the complaint form should be available from the websites and/or social media pages of MEE and the council. Physical copies of the form should be available from the council front office.</p> <p>Council will provide assistance to fill the form for those who cannot write.</p> <p>The council should keep separate registries for informal and formal complaints and maintain records of all complaints received.</p> <p>The council will discuss the matter with the Women’s Development Committee and other relevant stakeholders (Farmers, Fishermen, School, Health Center etc.), where deemed necessary and attain views of them. If such meetings are arranged, the date, time, location or venue, list of participants (with contact details) and a summary of the main outcome of the consultation must be annexed to the written decision issued by the council.</p> <p>If the complaint is resolved within 15 working days, the council must communicate the decision to the aggrieved party in writing.</p> <p>The aggrieved party must acknowledge the receipt of decision and submit their agreement or disagreement with the decision within 10 working days.</p> <p>If no acknowledgement is submitted from the aggrieved party within this period, then the decision will be considered as accepted.</p> <p>If a complaint requires more time to address, this requirement must be communicated to the aggrieved party in writing and the aggrieved party must consent and sign-off the request for</p>	<p>15 working days</p>

		<p>the extension to take effect. An extension can be made to an additional 15 working days.</p> <p>The staff designated as the waste management focal point by the island council will manage and provide feedback for grievances submitted to the council.</p>	
<p>Second Tier: Ministry of Environment, Climate Change and Technology</p>	<p>Environmental and Social Safeguards officer at the Project Management Unit (PMU) will be the focal point.</p>	<p>If the grievance cannot be resolved through Tier 1 to the satisfaction of the aggrieved party or if the issue is outside the jurisdiction of the council (issues related to RWMF), an aggrieved party may submit a complaint on the Tier 2 Complaint Form. A copy of the form (with MEE seal) should be provided to the aggrieved party as evidence of receipt. Electronic version of the complaint form should be available from the websites and/or social media pages of MEE and the council. Physical copies of the form should be available from the council and MEE front office.</p> <p>A copy of the Tier 1 Complaint Form should be submitted with the Tier 2 Complaint Form.</p> <p>MEE will forward the grievance to PMU.</p> <p>PMU screens the grievance and determine if its related to MCEP. If it is unrelated, the aggrieved party must be notified in writing and the way forward must be outlined to them including the necessary government institutions to follow up.</p> <p>Environment and Social Safeguards Officer at the PMU will be the contact person in processing a grievance through the Second Tier.</p> <p>PMU will discuss the matter with EPA and other relevant institutions, where deemed necessary and attains views of them. PMU will also arrange site visits and hold onsite discussions and meetings if necessary.</p> <p>The PMU will be responsible to ensure that there is no cost imposed on the aggrieved person, due to the grievance mechanism at the second tier.</p> <p>If the complaint is resolved within 15 working days, the PMU must communicate the decision to the aggrieved party in writing.</p> <p>The aggrieved party must acknowledge the receipt of decision and submit their agreement or disagreement with the decision within 10 working days.</p> <p>If no acknowledgement is submitted from the aggrieved party, then the decision will be considered as accepted.</p> <p>If a complaint requires more time to address, this requirement must be communicated to the aggrieved party in writing and</p>	<p>15 working days</p>

		<p>the aggrieved party must consent and sign-off the request for the extension to take effect. An extension can be made to an additional 15 working days.</p> <p>If the grievance is not resolved to the satisfaction of the aggrieved party within 15 working days of submission of the grievance to tier 2 then the aggrieved party may notify the MEE, in writing, of the intention to move to tier 3.</p>	
<p>Third Tier: Judiciary Power / Assistance to Vulnerable Persons beyond the Project's Grievance Redress Mechanism</p>	<p>Judiciary system is an option for an aggrieved person and/or community in case that the other tiers have not been effective</p>	<p>The legal system is accessible to all aggrieved persons.</p> <p>Assistance from the PMU of MCEP is available only for vulnerable person(s)* as per this grievance mechanism.</p> <p>In cases where vulnerable person(s) are unable to access the legal system, the Attorney General's office will provide legal support to the vulnerable person(s). The PMU must assist the vulnerable person(s) in getting this support from Attorney General's Office. PMU must also ensure that there is no cost imposed on the aggrieved person if the person belongs to the vulnerable groups. The list of vulnerable groups is as defined in the footnote but may be further defined by MEE.</p> <p>The verdict of the Courts will be final.</p>	<p>As per established Judicial Procedure</p>
<p>Fourth Tier: GBV/SEA/SH related incidents</p>	<p>Ministry of Gender, Family and Social Services</p>	<p>The role of the GRM when handling SEA/SH related complaints is to refer cases to an identified qualified service provider. For the MCEP, Ministry of Gender, Family and Social Services will be responsible to handle GBV/SEA/SH related complaints.</p> <p>The contact details of the atoll level Service Centre of the Ministry of Gender, Family and Social Services should be displayed in the project site along with the GRM information to report GBV/SEA/SH related complaints.</p> <p>Complaints related to GBV/SEA/SH should be addressed directly by the Service Centre of the respective atoll and the Gender Ministry will use its own case management system to address and respond to the case. Any GBV/SEA/SH incidents PMU also receives should be referred to the respective Service Centre of the Ministry of Gender, Family and Social Services.</p> <p>GBV/SEA/SH complaints should be registered in a safe, ethical and confidential manner keeping survivor information confidential and anonymous. The GRM focal points should be trained and knowledgeable on the protocols to follow when referring incidences to the Gender Ministry.</p> <p>Gender Ministry's Service Centre is required to immediately inform the PMU, and the PMU to immediately inform the World Bank of any GBV/SEA/SH incidences linked to project activities that have been reported. Only after having obtained consent from the survivor should the Gender Ministry's Service Centre report the incident to PMU. Survivor confidentiality</p>	<p>As per the protocols and guidelines of Ministry of Gender, Family and Social Services</p>

		<p>should be always protected to prevent any risks of stigmatization and reprisals against the survivor. Gender Ministry is under no obligation to provide case data to anyone without the survivor’s consent.</p> <p>When handling GBV cases, there are risks of stigmatization, rejection and reprisals against survivors. Hence, the Gender Ministry can share information when and if doing so is safe, and sharing of data will not put the survivor or service provider at risk for experiencing more violence. No information can be shared without the consent of the survivor. (Refer: WHO Ethical and safety recommendations for researching, documenting and monitoring sexual violence in emergencies: https://www.who.int/gender/documents/OMS_Ethics&Safety10Aug07.pdf)</p> <p>The PMU should obtain updates from the respective Gender Ministry’s Service Centre and keep World Bank informed (on a monthly or quarterly basis – depending on the case) until the case is closed. If the investigations revealed that the probability of the incident of GBV occurring was either created or exacerbated by the project, then corrective actions would be taken by the Borrower and the Bank to increase safety and security in the site locations.</p>	
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*Vulnerable person(s): A vulnerable person(s) for the purpose of this project is a person who is poor, physically or mentally disabled/handicapped, destitute, and disadvantaged for ethnic or social reasons, an orphan, a widow, a person above sixty years of age, or a woman heading a household.

CHAPTER 7 TRAINING RECOMMENDATIONS

Training is essential for ensuring that the ESMP provisions are implemented efficiently and effectively. MCEP shall therefore ensure that all persons that have roles to play in the implementation of the ESMP are competent with appropriate education, training or experience. Similarly, the contractors shall be required to undertake general HSE awareness for their project workforce and specific training for those whose work may significantly have impact on the environment. The Island Council in collaboration with the MCEP shall also devise and execute training programs targeted for staffs of IWRMC to facilitate effective and sound management of waste during household collection and operations of the centre. Furthermore, MCEP and the Island Council shall conduct community mobilization and public awareness programs to enhance knowledge of the community on good waste management practices and to promote implementation of 3R concept.

Table 38 Training program for the Implementation of ESMP

Training Activity	Participants	Type of Training and Content	Responsibility	Scheduling	Cost Estimates	Status
Strengthening capacity of contractor on reporting and implementation of ESMP	Managing Director and Site Supervisor of Contractor	Meeting Reporting Template	Safeguards Specialist of MCEP	Pre-bid meeting Kick-off meeting	NA	Completed
Strengthening PMU's capacity on compliance monitoring	APCs	Briefing Reporting Template	Safeguards Specialist of MCEP	Construction Phase	NA	Completed
General Awareness Health, Safety and Environment (HSE)	Worker on Site	HSE Introduction / Orientation (site safety rules, PPE, Emergency response etc.) Daily tool box talk for workers at the start of each day's job.	Site Supervisor of Contractor	Pre-construction phase. Construction phase	NA	-
Community Mobilization Fagandu Rollout	Waste Management Committee	Introduction to WM Policy Introduction to WM Regulation Roles of WMC	Communications Specialist of MCEP Community Engagement	During construction phase	Travel cost of facilitators. Designing and	Partially Completed Initial meeting held with

		<p>Implementation of IWMP</p> <p>Household waste segregation</p> <p>Door to Door campaign</p>	Coordinator of Th. Madifushi		<p>printing of training materials and flyers to be used for door to door campaign</p>	<p>the 5 institutions.</p> <p>Rollout plan formulated and discussed with the 5 institutions (Health, School, Local Businesses, Council, NGOs) and Police.</p>
<p>Compost Training (Training on the composting process using compost machine, including its operations, maintenance and servicing)</p>	IWRMC staffs	<p>Introduction to compost preparation using organic waste</p> <p>Step by step guidance using OWC machine for composting</p>	<p>Machine Supply Contractor</p> <p>Zone-4&5 Project Coordinator of MCEP</p> <p>WMPCD</p> <p>Island Council</p> <p>Communications Specialist of MCEP</p>	Prior to commencement of operations	<p>Travel cost of trainer</p> <p>Developing and printing of Training Manual</p>	-
<p>O&M and servicing of waste management equipment (glass crusher and baler)</p>	IWRMC staffs	<p>Routine servicing of the equipment</p> <p>O&M</p>	Equipment Supply Contractor	<p>Upon delivery of the equipment.</p> <p>Prior to commencement of operations</p>	Travel cost of trainer	-
<p>Fire safety training and drills</p>	<p>IWRMC staffs</p> <p>Nearby Residents</p>	<p>Introduction to Fire safety</p> <p>Hands on training of the equipment installed at IWRMC</p> <p>Details of safety procedures and</p>	<p>Maldives National Defence Force (MNDF) Fire and Rescue</p> <p>Island Council through retired firefighter</p>	Prior to commencement of operations	<p>Cost associated with training hall and refreshments</p> <p>Travel cost of trainer</p>	-

		evacuation plan during a fire				
Women Leadership in SWM training	Women Development Committee (WDC)	Enhancing women's participation in Solid Waste Management (SWM)	Island Council Communications Specialist of MCEP Zone 4&5 Project Coordinator of MCEP MCEP Project Manager	Throughout IWRMC operations	Travelling cost of trainers	-

CHAPTER 8: STAKEHOLDER CONSULTATIONS

8.1. Introduction

Consultations with the Island Council, the public and regulatory agencies were carried out through various stages of the project and during the preparation of ESMP 2018 and ESMP 2021. Fresh consultations were undertaken every time a change is brought to the project scope. Outcomes of these stakeholder consultations are well documented in the aforementioned 2 ESMPs (refer to page 140 – 147 of ESMP 2021).

Further consultations with the Island Council, MLSA, EPA, and Urban Planning and Projects Section of MNPHI were undertaken during the preparation of the current report. The public perception survey carried out in ESMP 2021 was repeated. The digital survey form was updated to reflect the location change and other related aspects.

8.2. Consultation with Madifushi Council, Projects Section of MNPHI and MLSA

A consultation was held with Madifushi Council, Projects Section of MNPHI (Water Supply System Proponent) and MLSA on 15 May 2023 to discuss about resolving the issues related to the IWRMC site. Summary of major discussion points are presented in **Table 39**.

Table 39 Summary of consultations with Madifushi Council, MNPHI and MLSA

Item	Description
Date	15 May 2023
Venue	Virtual – Microsoft Teams
Name of Stakeholders	Ministry of National Planning, Housing and Infrastructure representatives: <ul style="list-style-type: none">• Anoosha Hashim – Manager• Hawwa Ageela - Engineer Maldives Land and Survey Authority (MLSA) representatives: <ul style="list-style-type: none">• Ahmed Shaniu MCEP representatives: <ul style="list-style-type: none">• Ahmed Hassaan Zuhair, ESS Specialist• Mohamed Afraz, Civil Engineer• Eyman Ismail, Project Coordinator• Aishath Ajfaan Jawaad, Assistant Project Coordinator
Language of communication	Dhivehi

Summary**Waste and Resource Management Centre (WRMC) updates:**

- The location for WRMC was allocated in 2017 and approved by MLSA.
- Construction of WRMC was awarded to the contractor on 10 April 2023 and contractor mobilized to the island on 01 May 2023.
- Discussions with the Council was held in 4 April 2023, where the site, design and ESMP requirements were discussed in detail, however, issues relating to the site were not brought to the attention at that time.
- Location change was informed by the Council only upon the request to handover site to Contractor.
- There is an ongoing water supply system project in the same location and the infrastructure is almost completed.
- The EIA developed for the water supply system project specifies a different primary location and alternative location.
- Change of location can lead to numerous delays in the project duration.
- Compensation shall be given to the contractor for the idle charges.

Updates from Waste supply system development Project in Th.Madifushi

- Alternative location was chosen due to the effects of tidal swells (Udha) to the primary location.
- The final EIA document specifies alternative location as the IWRMC site.
- Separate approval is not sought from EPA to opt for alternative location.

MLSA

- As the approved location for WRMC is not available, selecting the location chosen by the Council is next feasible option.
- The dimensions of the WRMC can be replicated to the new LUP, thus designing of the centre will not be required.
- Zonal approval can be acquired from MNPI to expedite the process as the LUP is not approved.
- Water and sewage network should be checked by the water supply system projects team and Council.

8.3. Consultation with Madifushi Council and Urban Planning Department of MNPHI

Follow up discussions were held with Madifushi Council and Urban Planning Department of MNPHI on 16 May 2023 regarding expediting the land approval process of the new site. Summary of major discussion points are presented in **Table 40**.

Table 40 Summary of consultations with Madifushi Council, and Urban Planning Department of MNPHI

Item	Description
Date	16 May 2023
Venue	Virtual – Microsoft Teams
Name of Stakeholders	<p>Ministry of National Planning, Housing and Infrastructure (MNPHI) representatives:</p> <ul style="list-style-type: none"> • Nihaaza Anees <p>Madifushi Island Council representatives:</p> <ul style="list-style-type: none"> • Ahmed Nasheeth, Council President • Hassan Thasneem, Project Officer <p>MCEP representatives:</p> <ul style="list-style-type: none"> • Ahmed Hassaan Zuhair, ESS Specialist • Mohamed Afraz, Civil Engineer • Eyman Ismail, Project Coordinator • Aishath Ajfaan Jawaad, Assistant Project Coordinator
Language of communication	Dhivehi
Summary	<p>Waste and Resource Management Centre (WRMC) updates:</p> <ul style="list-style-type: none"> • The Environment and Social Management Plan (ESMP) was prepared based on the location approved in 2017. • With the change of location, ESMP needs to be changed and screening works can only be commenced after approval of the location. • Completion of ESMP will take one and a half month <p>Recommendation from MNPHI:</p> <ul style="list-style-type: none"> • Zonal approval for the location can be given within two working days thus can proceed with ESMP preparatory works <p>Madifushi Island Council</p> <ul style="list-style-type: none"> • Necessary documents for zonal approval will be shared with MNPHI in a day.

8.4. Household Perception Survey

The public perception survey done during the preparation of ESMP 2021 was repeated on 23 May 2023 to assess the respective perception of the households regarding the proposed waste management project. Relevant sections of the survey form were updated to reflected changes brought to the project scope (location change). Online platform 'KoboToolbox' was used for data collection and was facilitated by consultant's team. The surveyed households were mostly selected from the residential areas closest to the project site. A total of 11 households were surveyed. The following are the survey responses.



Figure 19 Survey response locations

a) Waste Segregation:

On the query of whether or not waste is segregated at their respective houses; all 11 households responded stating the waste is segregated.

They were further asked on the level of segregation. All of the 11 responses received, stated that waste is segregated to 3 categories.

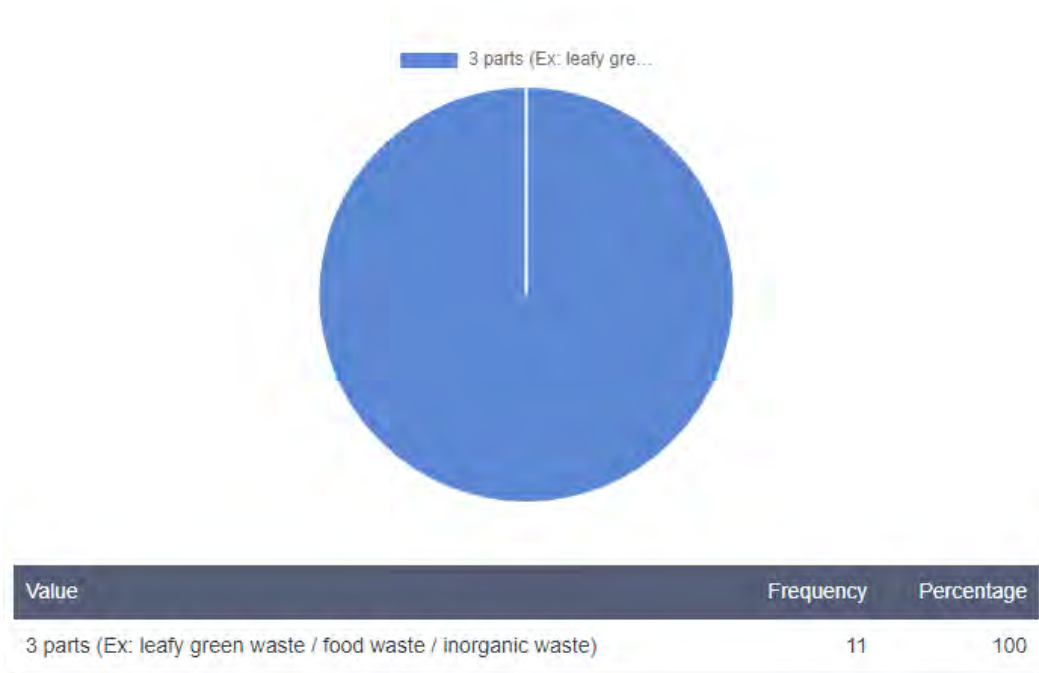


Figure 20 Waste Segregation Categories

b) Waste Collection Fee:

10 households (91%) indicated that they are satisfied with the collection fee proposed by the island council (MVR 150 per month), while 1 household (9%) indicated that they are not satisfied with the fee. The unsatisfied household has suggested to revised the fee to MVR 50 per month.

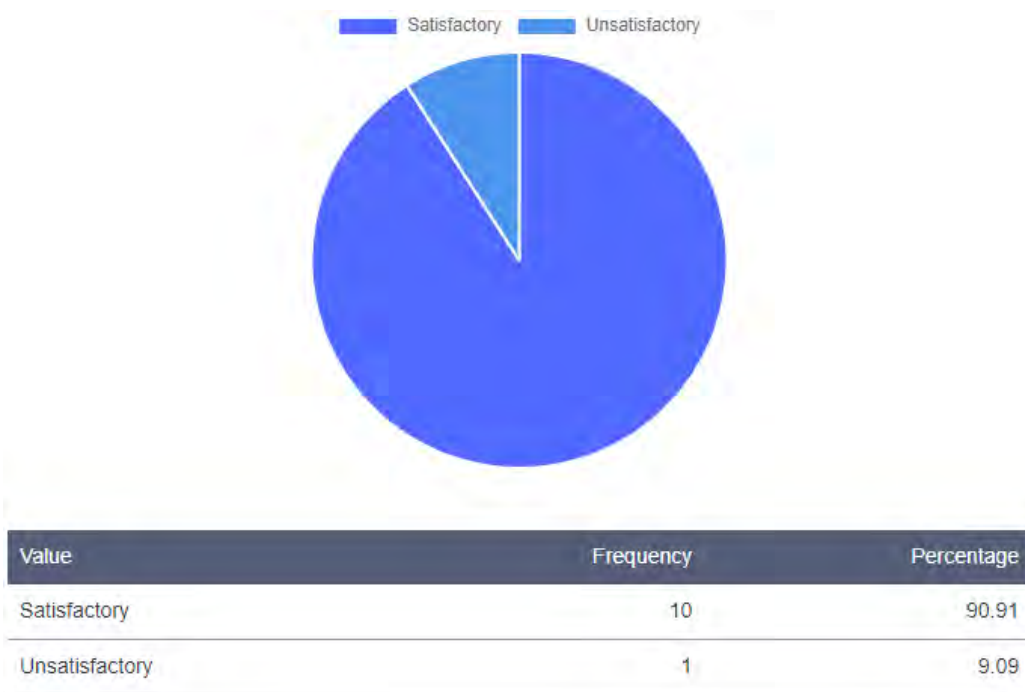


Figure 21 public view on proposed waste collection fee

c) Location of the proposed Island Waste and Resource Management Centre:

Furthermore, the perception study sought the community’s view regarding the proposed location of the IWRMC. It was found that 10 respondents felt satisfied with the proposed location, while 1 respondent felt unsatisfied, citing bad smell potentially arising from the IWRMC site as a reason.

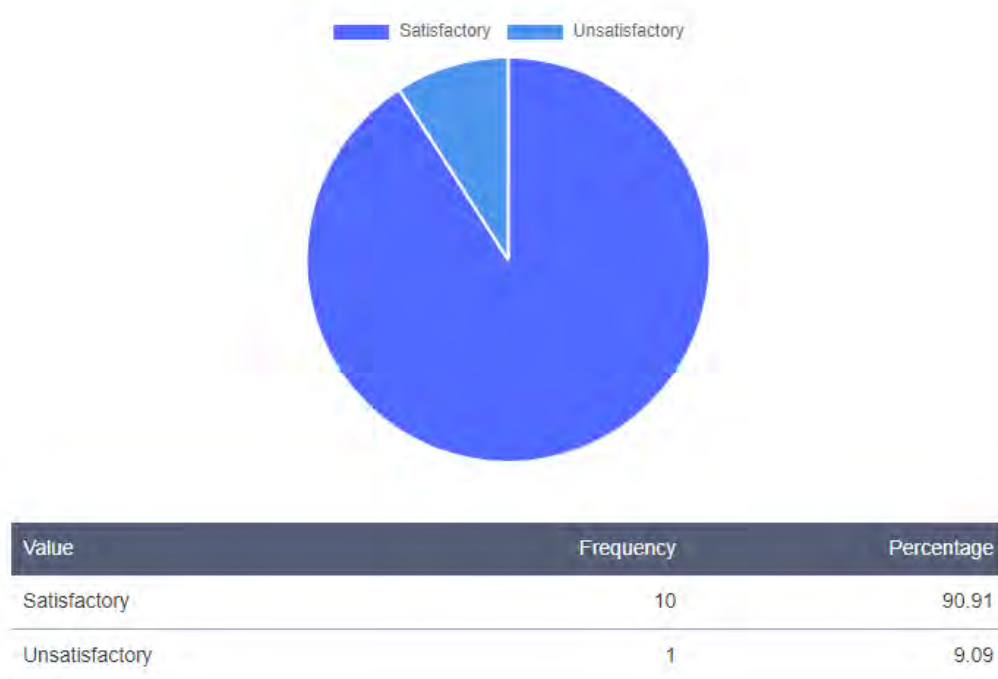


Figure 22 public views on the proposed location

However, it is important to note that, provided the nearest residential area is 175m north of the IWRMC site, coupled with in-vessel composting (in an enclosed room) being the proposed technology for treating organic waste, issue of smell will not arise.

d) Design and Features of the proposed Island Waste and Resource Management Centre:

Similarly, all of the respondents expressed satisfaction to the design and features of the IWRMC, and the proposed technology for treating organic waste.

8.5. Consultation with EPA

Environmental Compliance and Assessment Section (ERC) of EPA was consulted regarding the possibility of expediting ESMP approval process, since the contractor has mobilised to the site and to reduce idle charges and minimize damage to the contractor's equipment and materials.

EPA indicated that it would suffice to update relevant sections of the previous ESMP 2021, without undertaking an additional screening, as the impacts and mitigation measures are envisaged to remain the same, given the similarity of the existing environment of new location to the original location.

The email correspondence with EPA is provided in **Annex 3**.

The list of all the stakeholders consulted with their contact details are provided in **Annex 9**.

CHAPTER 9 GENDER ANALYSIS AND GENDER ACTION PLAN

This section of the report will describe the gender analysis and main barriers which may prevent women getting the intended benefits of the proposed project. Due to lack of site-specific data from Th. Madifushi, general data for Maldives is used for the analysis.

9.1. Gender Analysis and Barrier faced by Women

The prime legislature which is aimed to ensure the gender equality and women's empowerment in the country is Gender Equality Act (2016) which came into force in 2017. The main aim of this legislation is to eliminate discrimination based on sex or gender, including ending violence against women. The Act promoted gender equality in all aspects of public and family life. It also outlined duties and responsibilities on State and private parties, prohibited victimization and introduced remedies for gender-based discrimination. A national gender policy was developed in 2019 which includes five strategic goals; 1) Leadership and Governance; 2) Economic Empowerment, 3) Institutional Gender Mainstreaming 4) Gender Based Violence and 5) Access to Justice (Ministry of Gender, Family and Social Services 2020). The Strategic Action Plan (SAP) 2019-2023 included a "Gender Equality" subsector under the "Good Governance" sector. It recognized that "despite advancements in legal and policy framework including the passage of a domestic violence, a sexual harassment act and gender equality law, administrative, budgetary and human resource constraints restrict the implementation of these laws to achieve gender equality". The policy priorities of the Gender Equality subsector focused on "increasing women's representation in decision-making, minimizing sexual harassment, domestic violence, eliminating barriers for women to participate in economic activity including cultural barriers by promoting shared care work and household responsibilities.

Maldives is a signatory to the Convention on the Elimination of all forms of Discrimination Against Women (CEDAW) which was ratified in 1993. In a Global Ranking on gender gap issues, the Maldives is ranked number 113 out of a total of 149 countries, according to the World Economic Forum's Global Gender Gap Report 2018.

In the Maldives, the labour force participation rate of women was 42.2% when compared with men (75.1%) in 2019 (National Bureau of Statistics 2019) The women's share in wage employment was 39% and majority of the women work as employees (69%) and entrepreneurs (26%). In 2018, the Gender Parity Index (GPI) for found to be 0.93 for pre-primary level enrolment, 0.95 for primary level enrolment, 1.19 for upper secondary level enrolment and 0.89 for lower secondary level enrolment indicating a disparity in the favour of boys in all enrolment level except for the upper secondary level enrolment. However, one in every four women has experienced some form of violence in Maldives indicating gender-based violence is prevalent in the country.

The ESMF of MCEP consist an Gender Development Plan which identifies the following Gender Issues, Strategies and Proposed activities relevant to the project. The following **Table 41** provides the Gender Development Plan for MCEP.

Table 41 Gender Development Plan of MCEP

Gender issues	Strategy	Proposed Activities
Lack of awareness	Awareness campaign about the project for the community focusing on the vulnerable group including women.	Formation of women groups around specific project areas. Share information about the project benefits with local community.
Low Level of literacy	Support functional literacy campaign and develop extension programs to take the benefits from the project as per the needs of illiterates.	Undertake literacy programs as built- in activities coordinated with literacy programs. Develop the implementing strategies to communicate real time information specifically for economically weaker section. Develop audio-visual aids and documentary for training programs about the project for illiterate women groups.
Excluded from Opportunities and because of social boundaries as a result low level of participation in decision making process	Rapport building with Women Development Office at District or local level involving them in Program. Gender sensitization to all stakeholders including project entities. Ensure Women’s participation during meetings, project implementation and monitoring.	Carry out meetings and interaction program with and orientation to women in the community. Conduct leadership training for women members of commodity groups.
Lack of knowledge / access to technical knowhow	Promote need based technical awareness and support services.	Organize training on technologies. Provide opportunities of exposure or study visit to women's group to develop their leadership capacity.
Disparity in Wages	Accord Priority Employment to women in project generated construction activities. Promote equal wages for equal work.	Inform women groups regarding proposed construction works. Identify women interested to Work; assess their skills and involve them as per their

		capabilities. Monitor women wage rate and do the needful to ensure wage equality for similar type of construction works. Inclusion of the above elements in the contractors' document.
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9.2. Gender Action Plan

The following gender action plan presented in **Table 42** has been proposed based on the gender development plan of the MCEP. All the cost involved in implementation of Gender Action Plan has been considered in the cost estimates for the trainings.

Table 42 Gender action plan for the operations of the proposed IWRMC

Gender Activities/ Action	Indicators/Targets	Responsible Agency for implementation	Timeline
Ensure that women benefit from expanded and improved SWM collection, transfer and disposal services	Ensure 410 women in the island (census 2014) have access to the improved SWM facility.	MCEP PMU	Operational Phase
Carry out meetings and interaction program with and orientation to women in the community. Inform women groups regarding proposed construction works.	05% of the female population of the island are consulted.	Communications Specialist of MCEP	Pre-construction Phase
Develop audio-visual aids and documentary for training programs about the project for illiterate women groups.	Two audio-visual aids developed for compost and fire safety training.	Communication Specialist of MCEP PMU	Monitoring trips
Conduct leadership training for women members of community groups.	One leadership training conducted for WDC on SWM.	Communications Specialist of MCEP	Monitoring trips
Identify women interested to work; assess their skills and involve them as per their capabilities.	Involve at least 20% of women in the implementation of the IWMP.	Island Council	Operational Phase

CHAPTER 10 RECOMMENDATIONS AND CONCLUSION

The construction and development of the IWRMC at Th. Madifushi is a much-needed project to provide waste management services to the island. The IWRMC will be an improvement to the current waste disposal practices conducted in the island, while reducing the environmental pollution and providing health and economic benefits to the island.

The introduction of mechanical in vessel composting technique is perceived to expedite the compost production time considerably, while alleviating the labour intensiveness of the traditional open windrow composting method. Although the project is perceived to yield significant environmental and human health benefits and contribute towards achieving sustainable development goals, it should be understood that these benefits as outcomes would depend on smooth operations of the waste management system as a whole. In order for the system to function sustainably adequate resources in particular financial resources shall be made available. Part of the required funding could be obtained through introducing a fee structure for the service and sale of metals and compost. However, these revenue sources are not likely to be adequate enough for the entire operation. Hence, support from the government will be critical to maintain the system functional. Unavailability of the funds could mean breakdown of the transport system which could ultimately collapse the waste management service. Regular removal of residual waste from the island will have to be ensured as a key aspect of the project implementation. A regional collection and transport system in Zone 4&5 will be established under MCEP. The subject RWMF for Zone 4&5 will be Thilafushi, which is currently in the process of being developed to a full-fledged facility under the ADB financing.

Based on past experiences gained from projects of similar nature, it is also important to undertake a one-off clean-up activity of the island that includes removal of existing stockpile of waste. Failing to undertake this could lead to overloading of the waste management centre resulting failure to carry out the operational activities in the planned manner.

The construction and operational impacts that might arise from the project should be managed, mitigated and monitored on a continuous basis and should adhere to the EIA regulation all throughout the construction and operation of the project. Strict considerations are to be given to the pollution control as well as health and safety measures

The consultant's recommendations for the project include:

- Plan a one off clean up activity prior to the official opening of the waste management centre;
- plan and have in place a sea transfer arrangement to remove residual waste from the site on a regular basis;
- carryout necessary training for the waste management personnel in particular in the area of operating and maintaining the composting machine;

- adequate awareness raising of the general public on the operation and functioning of the new waste and resource management centre and sensitising the public on the rules and procedures that would come into effect with regards to the new waste management system;
- implementing fee for service system;
- strengthening enforcement capacity of the local authorities;
- provision of adequate financial and technical support at least for the initial 3 years into the project implementation to the island council;
- determine an operational plan for the centre that considers details of all aspects of operating, managing and sustaining the service;
- conduct supervision and monitoring of the project works by the Proponent;
- enforcement agency to make an effort to make at least one visit to the project site during the construction phase to ensure environmental compliance of the project activities; and
- proponent appoints a focal point to coordinate activities relating to monitoring and reporting.

This ESMP has looked into the key factors that need to be considered during construction and operational stage and identified all likely environmental impacts. Among other temporary and highly localised minor negative environmental impacts, the study has identified the following unavoidable moderately negative terrestrial impacts due to proposed development works:

- Almost an irreversible change the overall terrestrial environment as a result of the placement of the IWRMC footprint;
- generation of construction waste as a result of construction works.

The study also found that through the implementation of the proposed practical and cost-effective mitigation measures almost all identified impacts can be brought to an acceptable level. The study found no evidence of the project resulting loss of endangered or protected species or habitat.

Thus, based on the findings, it is concluded that the benefits on the environment and human health greatly outweighs the negative effects resulting from the implementation of the project.

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ANNEXES

ANNEX 1

EIA Screening Decision from EPA



شماره: 203-EIARES/438/2018/14

سولہویں نمبردار پروگرام

یہ ایک ایسی ایگزیکٹو ڈیکریشن ہے جس کے تحت سولہویں نمبردار پروگرام کے تحت درج ذیل کاموں کو جاری کیا جائے گا۔

و ڈیکریشن کے تحت ایگزیکٹو ڈیکریشن کے تحت درج ذیل کاموں کو جاری کیا جائے گا۔

و ڈیکریشن کے تحت ایگزیکٹو ڈیکریشن کے تحت درج ذیل کاموں کو جاری کیا جائے گا۔

و ڈیکریشن کے تحت ایگزیکٹو ڈیکریشن کے تحت درج ذیل کاموں کو جاری کیا جائے گا۔

و ڈیکریشن کے تحت ایگزیکٹو ڈیکریشن کے تحت درج ذیل کاموں کو جاری کیا جائے گا۔

و ڈیکریشن کے تحت ایگزیکٹو ڈیکریشن کے تحت درج ذیل کاموں کو جاری کیا جائے گا۔

یہ ایگزیکٹو ڈیکریشن سولہویں نمبردار پروگرام کے تحت درج ذیل کاموں کو جاری کرنے کے لیے ہے۔

سولہویں نمبردار پروگرام کے تحت درج ذیل کاموں کو جاری کیا جائے گا۔

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تاریخ: 10 ستمبر 2018

رکن، ایگزیکٹو کمیٹی
دائرۂ ماحولیات و آب و ہوا

ANNEX 2

Decision Statement of ESMP 2021



DECISION STATEMENT

مذكرة قرار بشأن الموافقة على خطة الإدارة البيئية والاجتماعية المقترحة لإنشاء مركز إبحار مياه عذبة في مفدوشي، جزر ثاا

APPROVAL OF THE ENVIRONMENTAL MANAGEMENT PLAN

Number: 203-ECA/438/2021/46 :مرفق رقم

مذكرة قرار بشأن الموافقة على خطة الإدارة البيئية والاجتماعية المقترحة لإنشاء مركز إبحار مياه عذبة في مفدوشي، جزر ثاا، والتي تم تقديمها للتقييم في 09th يناير 2021 وتم تقديم معلومات إضافية في 21st فبراير 2021 من قبل وزارة البيئة. الخبير البيئي لهذا المشروع هو **Mr. Ahmed Hassan Zuhair**.

*This Environmental Decision Statement is issued for the purpose of communicating the decision regarding the **Environmental and Social Management Plan for the Proposed Establishment of an IWRMC at Madifushi, Thaa Atoll**, which was submitted for evaluation on **09th January 2021** and submitted additional information on **21st February 2021** by **Ministry of Environment**. The environmental consultant of this project is **Mr. Ahmed Hassan Zuhair**.*

1. This Environmental Decision Statement has been issued on behalf of the Environmental Protection Agency (hereinafter referred to as the Ministry) pursuant to the Environmental Impact Assessment Regulations 2012 (2012/R-27) to advise that the Ministry has decided that the proposed project can proceed according to the Environmental Management Plan.

1. هذه الوثيقة هي بمثابة قرار صادر عن وزارة البيئة والمحافظة على الموارد الطبيعية نيابة عن الوزارة (سواء ما كان ذلك في إطار القوانين المعمول بها في دولة قطر) وذلك وفقاً للمواد 27 (2012/R-27) من لوائح تقييم الأثر البيئي لعام 2012 (2012/R-27) لتوصي بأن الوزارة قد قررت أن المشروع المقترح يمكن أن ينفذ وفقاً لخطة الإدارة البيئية والاجتماعية المقترحة.





2. The decision has been made by the Ministry on the following conditions:

2. في قراره، قد قررت الوزارة اعتماد الشروط التالية:

i. In the event the project activity has not commenced **within one (1) year** from the date of issue, or if the duration of this Environmental Decision Statement has not been extended, this Environmental Decision Statement shall be considered null and void.

i. في حالة عدم بدء نشاط المشروع في غضون سنة واحدة (1) من تاريخ إصدار القرار، أو إذا لم يتم تمديد مدة هذا القرار البيئي، فإن هذا القرار البيئي يعتبر باطلاً وبغير أثر.

ii. In the event the project activities have been delayed for more than one (1) year due to unforeseen circumstances, the Ministry shall have the discretion to extend the duration of the Environmental Decision Statement, or to terminate it. In such circumstances the proponent shall write to the Minister for an extension clearly stating out the reasons for the delay.

ii. في حالة تأخر أنشطة المشروع لأكثر من سنة واحدة (1) بسبب ظروف غير متوقعة، فإن الوزارة ستحتفظ بالسلطة التقديرية بتمديد مدة هذا القرار البيئي، أو إنهائه. في مثل هذه الظروف، يجب على مقدم الطلب كتابة رسالة إلى الوزير بطلب تمديد، مع توضيح أسباب التأخر بوضوح.

هذا القرار البيئي صادر في عمان بتاريخ 15/05/2024م الموافق 05/05/2024م



- iii. The Minister, or his designate, may issue a cessation order requiring persons working on a Development Proposal to cease working until the order is withdrawn, if:

 - a) This Environmental Decision Statement has been withdrawn or;
 - b) There has been a breach of the conditions of this Environmental Decision Statement.

- iv. It is the Developer’s responsibility to undertake all project activities in accordance with the relevant laws and regulations of the Maldives.

- v. The Developer is aware that under the National Environment Protection Act (Law no. 4/93) and the Environmental Impact Assessment Regulations the Ministry reserves the right to terminate any activity without compensation if found that such an activity has caused significant, irreversible impacts on the environment.

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- vi. All mitigation measures proposed in the EMP report for all the phases of the project shall be fully implemented.
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- vii. The date of expiry stated in this Environmental Decision Statement is the duration given to commence the project activities approved under this Environmental Decision Statement.
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- viii. Once the project activities have started, the Proponent must inform the Environmental Protection Agency, the date of commencement of project activities.
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Date of initial Issue: 24th February 2021

ٲسٲع مٲٲجئ : 24 ءسٲع مٲٲجئ 2021

Date of expiry: 24th February 2022

ٲسٲع مٲٲجئ : 24 ءسٲع مٲٲجئ 2022

Name: Mr. Ibrahim Naeem

ٲسٲع: ءسٲع مٲٲجئ مٲٲجئ مٲٲجئ

Designation: Director General

ٲسٲع: ءسٲع مٲٲجئ مٲٲجئ مٲٲجئ

Signature:

ٲسٲع:

ٲسٲع فوٲرئ ءسٲع مٲٲجئ ءسٲع ءسٲع ءسٲع ءسٲع

ANNEX 3

Letter from EPA informing to update the ESMP to reflect change in location

Re: Updating Th. Madifushi ESMP

Safa Ahmed <safa.ahmed@epa.gov.mv>

Wed 5/17/2023 5:13 PM

To: Ahmed Hassaan <ahmed.hassaan@environment.gov.mv>

Cc: Environmental Compliance and Assessment <eca@epa.gov.mv>; Jumaina Hassan <jumaina.hassan@environment.gov.mv>; Aishath Ajfaan <aishath.ajfaan@environment.gov.mv>; Eyman Ismail <eyman.ismail@environment.gov.mv>; Mohamed Afraz <mohamed.afraz@environment.gov.mv>; **MCEP | Min. of Environment, Climate Change and Technology MV** <mcep@environment.gov.mv>; Yoosuf Rilwan <yoosuf.rilwan@epa.gov.mv>

Dear Hassaan,

Thank you for your email regarding the relocation of the WRMC site in Th. Madifushi. We have reviewed the information provided and understand the urgent nature of the request.

Based on our previous discussions, we acknowledge that if the scope of work for the WRMC remains unchanged and the anticipated impacts and mitigation measures proposed for the original site are applicable to the newly proposed site (54.2), you may proceed with updating the ESMP to reflect the new location. The updated ESMP should include a revised environment chapter, incorporating any necessary updates, and provide all relevant approvals from the Maldives Land and Survey Authority (MLSA) and other pertinent government authorities, as required.

Although an additional screening may not be necessary if the impacts and mitigation measures remain consistent, it would be advisable to include a clear justification in the updated ESMP to substantiate this approach. Such justification will aid external reviewers and the EPA during the evaluation process.

Please feel free to contact us if you have any further inquiries or require additional information.

Best regards,

On Wed, May 17, 2023 at 11:47 AM Ahmed Hassaan <ahmed.hassaan@environment.gov.mv> wrote:

Dear Safa,

As conversed, please be informed that we are required to shift the originally proposed WRMC site in Th. Madifushi (approved by Maldives Land and Survey Authority and reflected in the EPA approved ESMP of the project) to an adjacent area east of the site, since we recently found out that an RO plant building was constructed by MNPFI at the original location.

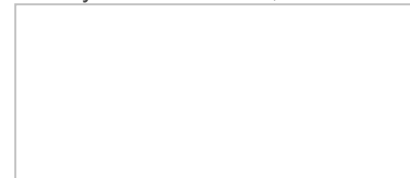
The original site is marked as 16.6 in the attached draft LUP prepared by Madifushi Council, and the newly proposed site as 54.2, which is also located at the reclaimed area of the island devoid of any vegetation, similar to the original site. Based on the series of discussions we have had over the last two days with urban planning, MLSA and the Island Council regarding the subject matter, it was confirmed that 54.2 is the most feasible location, as it meets all the requirements under the Maldives Land Act to construct the WRMC, and thus, zonal approval will be provided as soon as the Island Council submits the zonal application.

Since our WRMC contractor has already mobilized to the site with equipment and materials, we need to expedite all legal clearances to reduce idle charges and minimize damage to the contractor's equipment and materials. Therefore, as agreed verbally, we kindly request you to confirm in writing, if it would suffice to update the ESMP considering the new location (by updating the existing environment chapter and undertaking further stakeholder consultations) and resubmit it to EPA for your review and clearance, without undertaking an additional screening, as the impacts and mitigation measures will remain the same.

The original WRMC site approval issued by MLSA and a recent drone image of the area in contention are attached for your further reference. We would appreciate your prompt response on this, due to the urgency of the matter.

Best Regards,

Ahmed Hassaan Zuhair
Environmental and Social Safeguards Specialist
Maldives Clean Environment Project
Ministry of Environment, Climate Change and Technology



Ministry of Environment, Climate Change and Technology, Ameenee Magu, Maafannu, Male', 20392, Maldives.
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Email: ahmed.hassaan@environment.gov.mv | Web: www.environment.gov.mv

Find us on Facebook: <https://www.facebook.com/MCEP.mv/>

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Safa Ahmed
Assistant Director
Environmental Compliance and Assessment Section

Green Building, 3rd Floor, Handhuvaree Hingun, Maafannu,
Male', 20392, Republic of Maldives
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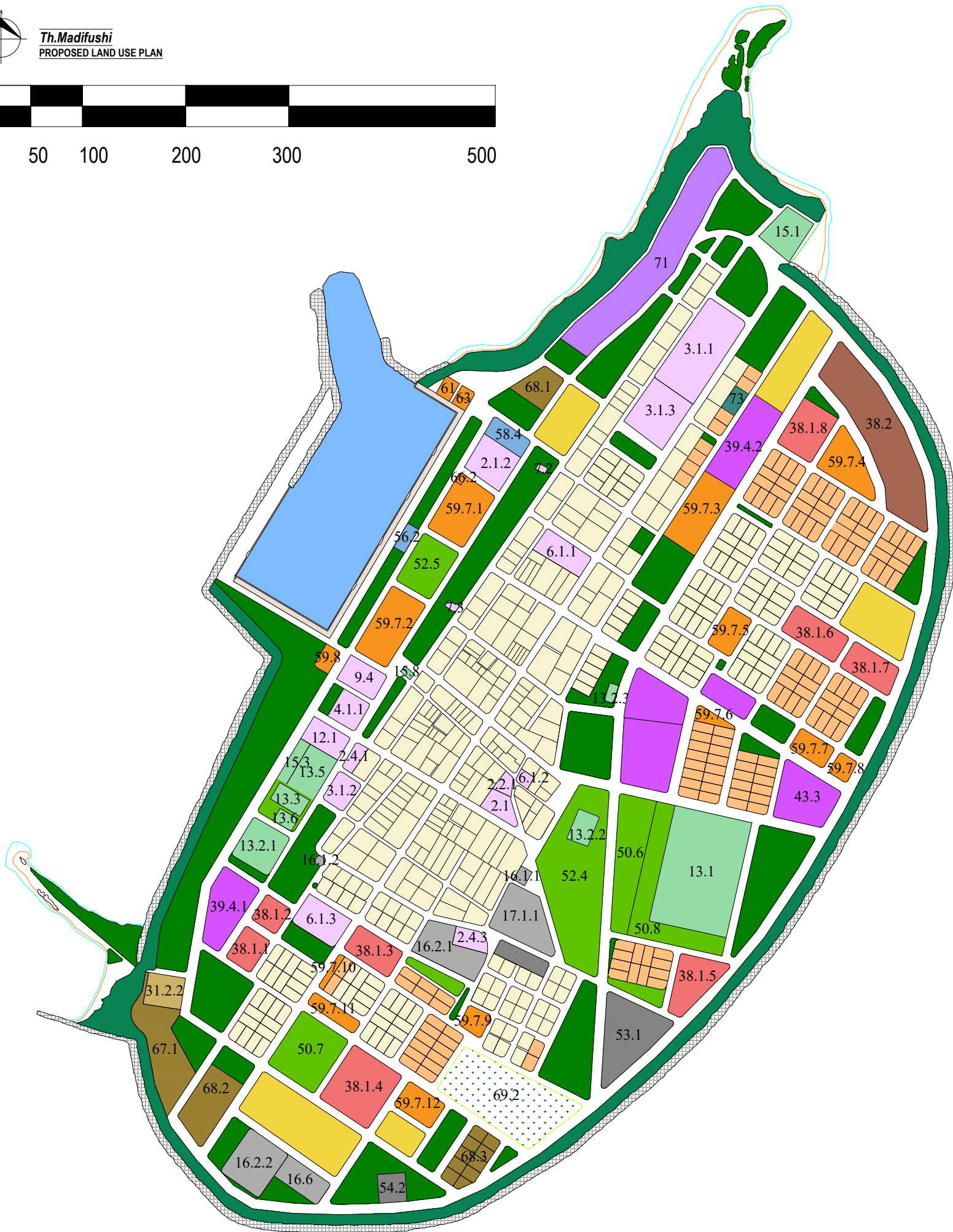
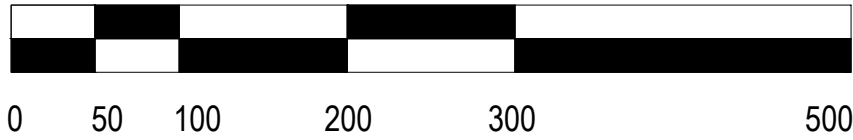
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ANNEX 4

Zonal Approval of IWRMC site



LEGEND

EXISTING:

- RESIDENTIAL PLOTS
- INSTITUTIONAL & COMMUNITY ZONE
 - 2. PUBLIC ADMINISTRATION
 - 2.1 COUNCIL OFFICE
 - 2.1.1 OLD COUNCIL OFFICE
 - 2.1.2 NEW COUNCIL OFFICE
 - 2.2 JUDICIAL
 - 2.2.1 MAGISTRATE COURT
 - 2.4.1 - 2.4.3 COUNCIL LAND
 - 3. EDUCATION
 - 3.1 SCHOOL
 - 3.1.1 MADIFUSHI SCHOOL
 - 3.1.2 PRE SCHOOL
 - 3.1.3 SCHOOL EXTENSION
 - 4. HEALTH
 - 4.1 HOSPITAL
 - 4.1.1 HEALTH CENTER
 - 6. ISLAMIC AFFAIRS
 - 6.1.1 - 6.1.3 MOSQUE
 - 7. PRIVATE ORGANIZATIONS
 - 7.2 MDP JAGAHA
 - 7.3 PPM JAGAHA
 - 9. POLICE
 - 9.4 ISLAND POLICE STATION
 - 12. COMMUNITY CENTER
 - 12.1 YOUTH CENTER

- SPORTS & RECREATION ZONE
 - 13. SPORTS STADIUM / COURT
 - 13.1 FOOTBALL STADIUM
 - 13.2.1 - 13.2.3 VOLLEYBALL COURT
 - 13.3 BASHI COURT
 - 13.5 FUTSAL GROUND
 - 13.6 NETBALL COURT
 - 15. PARKS AND OPEN SPACES
 - 15.1 CHILDRENS PARK
 - 15.3 POCKET PARK
 - 15.7 STAGE
 - 15.8 GYM
- UTILITY & MUNICIPAL SERVICE ZONE
 - 16. UTILITY
 - 16.1 TELECOMMUNICATION
 - 16.1.1 DHIRAGU ANTENNAE
 - 16.1.2 OOREDOO ANTENNAE
 - 16.2 POWER HOUSE
 - 16.2.1 OLD POWER HOUSE
 - 16.2.2 NEW POWER HOUSE
 - 16.6 RO PLANT
 - 17. MUNICIPAL
 - 17.1 CEMETERY
 - 17.2 WASTE
 - 17.2.1 WASTE MANAGEMENT CENTER
 - 17.5 OLD WATER PLANT
 - 17.6 RAIN WATER TANKS
- COMMERCIAL USE
 - 27. PETROL STATION
- INDUSTRIAL ZONE
 - 31. HEAVY
 - 31.2.1 - 31.2.2 BOAT BUILDING & REPAIR

PROPOSED:

- RESIDENTIAL PLOTS
 - 38.1.1 - 38.1.8 PUBLIC HOUSING UNIT
 - 38.2 PLOTS FOR SALE
- INSTITUTIONAL & COMMUNITY ZONE
 - 39. PUBLIC ADMINISTRATION
 - 39.4.1 - 39.4.2 OFFICE
 - 40. EDUCATION
 - 40.1 SCHOOL
 - 43. ISLAMIC AFFAIRS
 - 43.3 MOSQUE
- SPORTS & RECREATION ZONE
 - 50. SPORTS STADIUM / COURT
 - 50.6 OTHERS
 - 50.7 SPORTS PARK
 - 50.8 FOOTBALL GROUND EXTENSION
 - 52. PARKS AND OPEN SPACES
 - 52.4 RESERVED PARK
 - 52.5 COMMUNITY GATHERING SPACE
- UTILITY & MUNICIPAL SERVICES
 - 53. UTILITY
 - 53.1 TELECOMMUNICATION
 - 54. MUNICIPAL
 - 54.2 WASTE MANAGEMENT CENTRE
- TRANSPORTATION
 - 56. FERRY TERMINAL
 - 56.2 ISLAND FERRY TERMINAL
 - 58. LAND TRANSPORTATION
 - 58.1 PARKING
 - 58.4 DRIVING TRACK
- COMMERCIAL USE
 - 59. SHOPS
 - 59.7.1 - 59.7.12 OTHERS
 - 59.8 CAFE/ RESTAURANT
 - 61. ICE PLANT
 - 63. FUEL STORAGE
 - 66. BANKING
- INDUSTRIAL ZONE
 - 67. HEAVY
 - 67.1 SLIPWAY
 - 68. LIGHT
 - 68.1 WAREHOUSE
 - 68.2 WORKSHOPS
 - 68.3 FISH PROCESSING
- AGRICULTURE & MARICULTURE
 - 69. LAND
 - 69.2 FARMLAND
- TOURISM
 - 71. GUEST HOUSE
- MIXED USE ZONE
 - 73. MIXED RESIDENTIAL
- OPEN / GREEN BUFFER AREAS
- RESERVED FOR NON-RESIDENTIAL USE
- ENVIRONMENTAL PROTECTION ZONE

- PHYSICAL FEATURES**
- HARBOR BASIN
 - REEF LINE
 - REVETMENT / GROIN
- ROAD NETWORK**
- HARBOR LOADING/UNLOADING - 6M

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SECRETARIAT OF
TH.MADIFUSHI COUNCIL

Scale: 1:4500
Title: PROPOSED LAND USE PLAN
Date: 05th May 2023

TH.Madifushi Land use Plan
Client: Secretariat of TH.Madifushi Council

Project Number: R22320TMC
Date: 13th October 2022

Planner: AZ
Drafted by: AMS / AR
Surveyed by: BP00706
Surveyed on: 28th October 2022

ANNEX 5

CV of the ESMP Consultant

CURRICULUM VITAE (CV)

Name	Ahmed Hassaan Zuhair
Nation Identification No	A073471
Date of Birth	02 August 1985
Country of Citizenship/Residence	Maldives
Permanent Address	G. Vehi, Kashimaahingun, K. Male, Maldives
Present Address	H. Maaniga, Sikka Goalhi, K. Male, Maldives
Contact Details	Phone: +960-7886707 Email: hassaan.zuhair@gmail.com

1. EDUCATION

Period	Qualification	Name of the Institution	Country	Medium of Instruction
Mar 2014 – Dec 2015	Master of Urban and Environmental Planning	Griffith University	Australia	English
Jul 2007 – Jun 2010	Bachelor of Science (Chemistry, Earth Science, Environmental Science)	University of Mysore	India	English
Jun 2002 - Jun 2004	London GCE Advanced Level	Centre for Higher Secondary Education	Maldives	English
Jan 1999 – Jan 2002	London GCE Ordinary Level	Majeedhiyya School	Maldives	English

2. PROFESSIONAL TRAINING, SHORT-TERM COURSES AND WORKSHOPS

- Training Course - Towards Seamless EIA-EMS Connection 6-7 May 2023
Kuching, Malaysia
- Software and Service Training of P2000 Continuous Emissions Monitoring Equipment (Protea Ltd.) 4 Nov 2021
R. Vandhoo, Maldives
- The Environmental and Social Framework in Practice Sri Lanka/Maldives CMU Training 22 – 26 Mar 2021
Virtual
- Environmental and Social Framework – ESF Fundamentals (The World Bank’s E-learning Course) Mar 2021
Virtual
- Safeguards Application Training 23 – 24 Jan 2020
Colombo, Sri Lanka
- Training on Geo- Enabling Method for Monitoring and Supervision (GEMS) 15 – 20 Sep 2019
Chennai, India
- TESTO Mobile Stack Emissions Monitoring Training 6 Feb 2019
Male’, Maldives
- Introduction to Mapping with Drones Geoinformatics Center, Asian Institute of Technology (AIT) 10 – 14 Sep 2018
Pathumthani, Thailand
- World Bank Procurement Training 2 - 4 Oct 2017
Colombo, Sri Lanka
- Training Program for Environmental Regulators 19 - 30 Nov 2012
New Delhi, India
- UNITAR Regional Workshop on Nanotechnology and Manufactured Nanomaterials 6 - 7 Sep 2011
Beijing, China
- UNEP/OECD Workshop on Perfluorinated Chemicals and transition to safer alternatives 5 Sep 2011
Beijing, China

- Capacity building in ecosystem-based management approaches for the Coastal areas in the Maldives 18 – 20 June 2007
The University of Queensland
- Training on preparation and interpretation of Climate Risk profile for the Maldives 20 – 21 Feb 2006
Ministry of Environment,

3. CONFERENCES AND SEMINARS ATTENDED

- IAIA Conference 2023 8 -11 May 2023
Kuching, Malaysia
- IAIA Conference 2022 4-7 May 2022
virtual
- ISWA Beacon Conference 13 – 15 Dec 2019
Singapore
- Fifth Asia-Pacific Climate Change Adaptation Forum 17 – 19 Oct 2016
Colombo, Sri Lanka
- UNCC 2016 Forum of the Standing Committee on Finance
Financial instruments that address the risks of loss and damage associated with the adverse effects of climate change. 5 – 6 Sep 2016
*ADB Headquarters
Manila, Philippines*
- Consultation for the Asia-Pacific Region in preparation for the fifth session of the intergovernmental negotiating committee on mercury 31 Oct - 1 Nov 2012
Bangkok, Thailand
- Tbilisi+35: Intergovernmental conference on Environmental Education for Sustainable Development 6 - 7 Sept 2012
Tbilisi, Georgia
- Third Asia Pacific Regional Meeting on SAICM 8 - 9 Sep 2011
Beijing, China
- Seminar on Integrated Coastal Management for Developing Countries Oct/Nov 2010
Xiamen, China

4. EMPLOYMENT RECORD

Period	Employing organization and title/position. Contact information for references	Country	Summary of major activities performed
July 2018-present	<p>Ministry of Environment, Climate Change and Technology (MoECCT) / The World Bank Group</p> <p>Environmental and Social Safeguards Specialist of Maldives Clean Environment Project (MCEP).</p> <p>MCEP is a solid waste management project targeted for the catchment area of Zone 2, Zone 4 and 5, comprised of 88 inhabited island and 2 Regional Waste Management Facilities. The project is a \$17.5 million International Development Association – World Bank grants project with a Category A Safeguards Rating.</p> <p>Referees:</p> <p>Mokshana Wijeyeratne, Senior Environmental Specialist, The World Bank Group Contact: +94-11-2448070 Email: mwijeyeratne@worldbank.org</p> <p>Shanek Mario Fernando, Social Development Specialist, The World Bank Group Contact: + 94-77-2618872 Email: sfernando6@worldbank.org</p>	Maldives	<ul style="list-style-type: none"> • Assisted in the World Bank in the preparation of the Environmental and Social Assessment and Management Framework (ESMAF) Of MCEP (World Bank Document). Undertook atoll level stakeholder consultation at Zone 4&5 and wrote the chapter. Prepared the executive summary in both English and Dhivehi Language. • Formulated the Grievance Redress Mechanism (GRM) of MCEP and developed the associated complaint forms. Obtained clearance from the World Bank and disclosed the GRM in project sites. • Provided training on GRM implementation to focal points selected from sub-project islands. • Ensured implementation of the GRM at subproject islands. • Prepared EIA screening documents, screened the subprojects and attained screening decision from the EPA and the World Bank. • Participated and provided information at the EIA scoping meetings. • Prepared Environmental and Social Management Plans (ESMPs) for the establishment/upgrading of Island Waste and

	<p>Ahmed Murthaza, Project Director, MCEP Contact: +960-7677404 Email: ahmed.murthaza@environment.gov.mv</p>		<p>Resource Management Centers (IWRMCs) in 8 sub-project islands. Facilitated clearance from the Safeguards Division of the World Bank and the Maldives EPA. Disclosed the cleared reports in project sites.</p> <ul style="list-style-type: none"> • Prepared Preliminary Environmental and Social Management Plans (ESMPs) for the establishment/upgrading of Island Waste and Resource Management Centers (IWRMCs) in 6 sub-project islands to include in the respective bid documents. The reports were cleared by the Safeguards Division of the World Bank. • Ensured timely delivery and approval of further 20 ESMP reports through close coordination and guidance to the selected consultants. Developed technical and outline TORs, reviewed the draft reports and identified gaps and areas requiring enhancement. Facilitated clearance from the Safeguards Division of the World Bank and the Maldives EPA. Disclosed the cleared reports in project sites. • Ensured timely delivery and approval of the Environmental and Social Impact Assessment (ESIA) for the proposed upgrading of civil works at Regional Waste Management Facility (RMWF) Zone II, Raa Vandhoo, through close coordination and providing guidance to the selected consultant. Developed the technical and outline TOR, reviewed the draft reports and identified gaps and areas requiring enhancement. Facilitated clearance from the World Bank at the Regional Safeguards Advisor (RSA) level and the Maldives EPA. Disclosed the cleared report.
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		<ul style="list-style-type: none"> • Developed Operational Environmental Management Plan (O-ESMP) of Zone II RWMF, in reference to the subject ESIA and the World Bank’s Environmental and Social Health and Safety (ESHS) guidelines for Waste Management Facilities. Attained clearance from the World Bank and provided training to the operator. • Ensured environmental and social safeguard measures are adequately implemented during implantation of the subprojects at island and regional level. • Developed remote O-ESMP monitoring tool through KoBo Toolbox application. Trained the operator on the use of the tool and reporting requirements. Ensured timely submission of monitoring reports by the operator to the EPA and the World Bank. Reviewed the reports submitted by the operator, identified gaps and areas requiring enhancement. • Developed remote ESMP monitoring tool and subsequent reporting mechanism on KoBo Toolbox for IWRMC subprojects. Trained the respective island council focal points on the use of the form and reporting requirements. • Developed sample Company and Individual Code of Conducts to provide to the contractors. The codes were developed in accordance to the ESHS, Operational Health and Safety (OHS) and in reference to prevention of Gender Based Violence (GBV) and Sexual Exploitation and Abuse (SEA) standards of the World Bank.
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			<ul style="list-style-type: none"> • Ensured resettlements and compensation are issues for project affected communities prior to commencement of civil works through compensating for privately owned vegetation falling at project sites. • Developed safeguards guidance notes, which includes ESMP mitigation measure, COVID19 special considerations and reporting templates for respective monthly contractor’s monitoring reports • Ensured timely implementation of corrective actions by the contractors in cases of identification of non-compliance issues during monitoring. This was achieved through close coordination and contractual interventions such as withholding payments. • Prepared ESMP construction phase monitoring reports of all the completed sub-projects (8 projects in total) and submitted to the World Bank and the EPA. • Reviewed the Feasibility Study of Zone 4&5 and provided inputs and comments.
Mar – Oct 2020	<p>Consultant for the World Bank (on Voluntary Basis)</p> <p>Environmental Safeguards Specialist (seconded staff handpicked by the World Bank) of Maldives COVID19 Emergency Response and Health Systems Preparedness Project (COVID-19 ERHSPP) for the project preparatory phase.</p>		<ul style="list-style-type: none"> • Reviewed and commented on the Environmental and Social Commitment Plan and the Stakeholder Engagement Plan (World Bank documents). • Co-authored the Environmental and Social Management Framework (ESMF) of Maldives COVID19 Emergency Response and Health Systems Preparedness Project (World Bank Document). This includes writing environmental chapters of the

	<p>COVID-19 ERHSPP is \$7.3 million International Development Association – World Bank credit project emphasized on assisting the Maldives to prevent, detect, and respond to the COVID-19 pandemic and strengthen its public health preparedness. The project is ranked as a Safeguards Category A project.</p> <p>Referees: Mokshana Wijeyeratne, Senior Environmental Specialist, The World Bank Group Contact: +94-11-2448070 Email: mwijeyeratne@worldbank.org</p>		<p>ESAMF, developing generic healthcare waste management plan and generic environmental management plan. Following are the main tasks completed under this assignment:</p> <ul style="list-style-type: none"> - Wrote the executive summary both in Dhivehi and English language. - Wrote Chapter 2: Introduction to Prevailing Salient Environmental and Social Conditions and Healthcare Waste Management. - Wrote some sections of Chapter 3: Environmental, Health and Social Legislation, Regulatory and Institutional Framework in the Republic of Maldives. - Developed Annex 3: SOPs of HPA and BCP and resort waste segregation guideline of WAMCO. - Developed Annex 4: Specs of 100L autoclaves with shredders. - Developed Annex 5: Guidelines for types of waste accepted at R. Vandhoo RWMF. - Developed Annex 6: Autoclave and consumable list for Zone 4&5 HF's - Developed Annex 7: Summary of Health Care Facilities in the Maldives and Healthcare Waste Management Plan (HCWMP) and WASH. - Provided input in developing Annex 9: Generic Environmental and Social Management Plan for Implementation of COVID-19 response sub-projects. - Provided input in developing Annex 10: Generic Infection Control and Healthcare Waste Management Plan for COVID-19 Responses in Healthcare Facilities. - Developed Annex 13: Environmental and Social Clearance Procedure with the EPA - Developed Annex 14: EPA EIA Screening Form and Translated Version
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			<ul style="list-style-type: none"> - Developed Annex 15: Typical Structure of an Environmental and Social Impact Assessment - Prepared the environmental guidance for isolation and quarantine facilities - Report compilation, proof reading and correcting errors. <ul style="list-style-type: none"> • Evaluated the compatibility of the incinerators available at the Maldives (based at Thilafushi and Hulhumale’ hospital) for the treatment/disposal of residual healthcare waste. • Recommended best practice guidance to Waste Management Corporation (WAMCO) on managing the residual healthcare waste at Farukolhufushi quarantine facility in contained burners with chimneys. • Organized and lead the discussion between Ministry of Health, Health Protection Agency, Environmental Protection Agency and MoECCT on possible options for final disposal of residual healthcare waste. • Developed TOR for consultancy services for the position of permanent Environmental Safeguards Specialist. Assisted in the selection process by evaluating the EOIs and carrying out the job interviews for Ministry of Health.
July 2017- June 2018	Ministry of Environment Climate Change and Technology (MoECCT) / The World Bank Group	Maldives	<ul style="list-style-type: none"> • Similar to the tasks performed as Environmental and Social Safeguards Specialist of Maldives Clean Environment Project (MCEP). Refer to the relevant section.

	<p>Environmental and Social Safeguards Officer of Maldives Clean Environment Project (MCEP).</p> <p>MCEP is a solid waste management project targeted for the catchment area of Zone 2, Zone 4 and 5, comprised of 88 inhabited island and 2 Regional Waste Management Facilities. The project is a \$17.5 million International Development Association – World Bank grants project with a Category A Safeguards Rating.</p> <p>Referees:</p> <p>Mokshana Wijeyeratne, Senior Environmental Specialist, The World Bank Group Contact: +94-11-2448070 Email: mwijeyeratne@worldbank.org</p> <p>Susrutha Goonasekera, Former Social Development Specialist of the World Bank Group (Current Senior Social Development Specialist at AIIB) Contac: +94-77-2950066 Email: susrutha.goonasekera@aiib.org</p> <p>Ahmed Murthaza, Project Director, MCEP Contact: +960-7677404 Email: ahmed.murthaza@environment.gov.mv</p>		
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<p>Mar 2016 – May 2017</p>	<p>Ministry of Environment Climate Change and Technology (MoECCT).</p> <p>Environmental Analyst, Coastal Unit</p> <p>Referees: Ajjwad Musthafa, Permanent Secretary, MoECCT Contact: +960-758100 Email: ajwad.musthafa@environment.gov.mv</p>	<p>Maldives</p>	<ul style="list-style-type: none"> • Managed Coastal projects funded by the Public Sector Investment Program (PSIP) of the Maldives and donor assisted projects, namely, the Facility for Infrastructure Development ORIO and Kuwait Fund for Arab Economic Development. • Ensured the implementation of the project components are in line with the government policies and/or donor requirements. • Interacted with the financial, procurement and technical staff of the Ministry and EPA to enable smooth implementation of the project components. • Coordinated among the stakeholders including the atoll/island councils, contractors and engineers in resolving various issues that come up during the implementation. • Processed bills raised by contractors. • Preparation and compilation of the project progress reports, quarterly reports and updates in a timely manner. • Provided information, monthly progress reports and other documentation requested by the Project Director for review and/or for presentation to Steering/Technical committees, donor review missions or by other relevant authorities of the Government in a timely manner.
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			<ul style="list-style-type: none"> • Preparation of Terms of Reference, Tender Documents and Evaluation of Bids and Proposals. • Preparation of Contract Documents and Contract Amendments. • Monitored the progress of project activities on a regular basis. • Visited project sites periodically and reported back on the status of on-site activities to the management. • Participated in EIA scoping meetings related to the project and guided contractors in the EIA application process. • Ensured that the projects are formulated in an environmentally friendly and sustainable manner by consulting EPA and other relevant parties.
July 2010 - Dec 2013	<p>Ministry of Environment Climate Change and Technology (MoECCT).</p> <p>Environmental Analyst, Information Communications and Awareness Unit / Legal Unit</p> <p>Referees: Mohamed Zahir, Director General, Environment Department, MoECCT</p>	Maldives	<ul style="list-style-type: none"> • Conducted regional environmental awareness sessions in different atolls. • Conducted waste management workshops in different regions of Maldives. • Organized and celebrated major environmental significant days at national level.

	Contact: +960-7771504 Email: mohamed.zahir@environment.gov.mv		<ul style="list-style-type: none"> • Prepared booklets, brochures and newsletters in view to increase public knowledge on existing environmental issues in Maldives. • Created Environmental Awareness through Media. • Assisted legal unit in drafting solid waste management regulation, standards on biodegradable plastic bags and Environmental impact assessment regulation.
Feb 2005 – July 2007	<p>Ministry of Environment Climate Change and Technology (MoECCT).</p> <p>Environment Officer (Trainee), Information Communications and Awareness Unit</p> <p>Referees: Mohamed Zahir, Director General, Environment Department, MoECCT Contact: +960-7771504 Email: mohamed.zahir@environment.gov.mv</p>	Maldives	<ul style="list-style-type: none"> • Aided in facilitating and carrying out various works in relation to environmental awareness and community mobilization. • Wrote and published 2005 World Environment Day Awareness handbook. • Conducted a weekly environmental awareness raising radio program on national radio.

Note: Ministry of Environment, Climate Change and Technology (MoECCT) was formerly known as Ministry of Environment (ME), Ministry of Environment and Energy (MEE), Ministry of Housing and Environment (MHE), Ministry of Housing, Transport and Environment (MHTE) etc.

5. MEMBERSHIP IN PROFESSIONAL ASSOCIATION AND AWARDS, HONORS AND COMMENDATIONS:

- Registered EIA Reviewer in EPA (since April 2016)
- PIA (Planning Institute of Australia) Awards for Planning Excellence 2015 - Commendation for Outstanding Student Project “Connected with Water: Integrated and Adaptive Water Management Framework” – University Sponsored by Queensland Government.
- Griffith Award for Academic Excellence 2015.
- Griffith Award for Academic Excellence 2014.
- Australia Awards Scholarship 2014.
- Certificate of Acknowledgement in recognition of outstanding contribution to Earth Hour campaign 2013.
- Certificate of Achievement (Discipline Prize), Majeediyya School.
- Certificate of Achievement (Passed in all curriculum subjects), Majeediyya School.

6. LANGUAGE SKILLS:

Language	Speak	Read	Write
English	Excellent	Excellent	Excellent
Dhivehi	Excellent	Excellent	Excellent

7. REPORTS AND PUBLICATIONS

Title of Assessment	Country	Date	Status of clearance	Proponent / Client	Funding Agency	Nature of the Assignment	Role	Summary of major activities performed
Construction Phase Monitoring Report under the ESIA for upgrading of Zone II RWMF at R. Vandhoo	Maldives	Nov 2021	Submitted to the World Bank and EPA and disclosed	Ministry of Environment Climate Change and Technology	World Bank	Waste Management	Lead Consultant	Report writing, compliance assessment, monitoring investigations, data analysis and interpretation, management of grievances etc. Report Link
ESMP Monitoring Report for the Establishment of IWRMC in N. Holhudhoo (Construction Phase)	Maldives	Sep 2021	Submitted to the World Bank and EPA	Ministry of Environment Climate Change and Technology	World Bank	Waste Management	Lead Consultant (Individual)	Report writing, field investigations, compliance assessment, monitoring investigations, consultation with the Island Council etc.
ESMP Monitoring Report for the Establishment of IWRMC in R. Maakurathu (Construction Phase)	Maldives	Sep 2021	Submitted to the World Bank and EPA	Ministry of Environment Climate Change and Technology	World Bank	Waste Management	Lead Consultant (Individual)	Report writing, field investigations, compliance assessment, monitoring investigations, consultation with the Island Council etc.

ESMP for the proposed establishment of Island Waste and Resource Management Centre in Th. Buruni	Maldives	Mar 2021	Cleared by the World Bank and the Maldives EPA and disclosed	Ministry of Environment Climate Change and Technology	World Bank	Waste Management	Lead Consultant (Individual)	Report writing, undertook stakeholder consultations, public/community perception survey, field investigations, impact assessment, devised construction and operational phase mitigation and monitoring plans, Grievance Redress Mechanism etc. Report Link
ESMP for the proposed establishment of Island Waste and Resource Management Centre in Th. Madifushi	Maldives	Jan 2021	Cleared by the World Bank and the Maldives EPA and disclosed	Ministry of Environment Climate Change and Technology	World Bank	Waste Management	Lead Consultant (Individual)	Report writing, undertook stakeholder consultations, public/community perception survey, field investigations, impact assessment, devised construction and operational phase mitigation and monitoring plans, Grievance Redress Mechanism etc. Report Link
Preliminary Construction Phase ESMP for the proposed construction of IWMC in M. Mulah, Th. Buruni, Th. Madifushi, Th.	Maldives	Oct 2020	Cleared by the World Bank	Ministry of Environment Climate Change and Technology	World Bank	Waste Management	Lead Consultant (Individual)	Report writing, site details, mitigation measures for construction phase, cost estimates for ESMP implementation etc.

Kinbidhoo, Th. Omadhoo and Th. Thimarafushi								
ESMP Monitoring Report for the Establishment of IWMC in R. Ungoofaaru (Construction Phase)	Maldives	June 2020	Submitted to the World Bank	Ministry of Environment Climate Change and Technology	World Bank	Waste Management	Lead Consultant (Individual)	Report writing, field investigations, compliance assessment, monitoring investigations, consultation with the Island Council etc.
Environmental and Social Management Framework (ESMF) of Maldives COVID19 Emergency Response and Health Systems Preparedness Project	Maldives	May 2020	Cleared by the World Bank and disclosed	World Bank	World Bank	Environmental and social assessment and management framework and resettlement policy framework	Co-Author	Executive summary, report writing, data analyses, baseline information, healthcare waste management plan, generic ESMP, report compilation, proof reading etc. Report Link
Stakeholder Engagement Plan (SEP) Maldives COVID-19 Emergency Response and Health Systems Preparedness Project	Maldives	May 2020	Cleared by the World Bank and disclosed	World Bank	World Bank	Stakeholder Engagement	Report Reviewing	Reviewed the draft report and provided comments to the World Bank. Report Link

Environmental and Social Commitment Plan (ESCP) - Maldives COVID-19 Emergency Response and Health Systems Preparedness Project	Maldives	Mar 2020	Cleared by the World Bank and disclosed	World Bank	World Bank	Environmental and Social Commitment Plan	Report Reviewing	Reviewed the draft report and provided comments to the World Bank. Report Link
ESMP Monitoring Report for the Establishment of IWMC in B. Dhonfanu (Construction Phase)	Maldives	Mar 2020	Submitted to the World Bank and EPA	Ministry of Environment Climate Change and Technology	World Bank	Waste Management	Lead Consultant (Individual)	Report writing, field investigations, compliance assessment, monitoring investigations, consultation with the Island Council etc.
ESMP Monitoring Report for the Establishment of IWMC in B. Hithaadhoo (Construction Phase)	Maldives	Jan 2020	Submitted to the World Bank and EPA	Ministry of Environment Climate Change and Technology	World Bank	Waste Management	Lead Consultant (Individual)	Report writing, field investigations, compliance assessment, monitoring investigations, consultation with the Island Council etc.
ESMP for the proposed establishment of Island Waste Management Centre in R. Maakurathu	Maldives	Dec 2019	Cleared by the World Bank and the Maldives EPA and disclosed	Ministry of Environment Climate Change and Technology	World Bank	Waste Management	Lead Consultant (Individual)	Report writing, undertook stakeholder consultations, public/community perception survey, field investigations, impact assessment, devised construction and operational phase mitigation and monitoring plans, Grievance Redress Mechanism etc. Report Link

ESMP for the proposed upgrading of Island Waste Management Centre in N. Holhudhoo	Maldives	Oct 2019	Cleared by the World Bank and the Maldives EPA and disclosed	Ministry of Environment Climate Change and Technology	World Bank	Waste Management	Lead Consultant (Individual)	Report writing, undertook stakeholder consultations, public/community perception survey, field investigations, impact assessment, devised construction and operational phase mitigation and monitoring plans, Grievance Redress Mechanism etc. Report Link
ESMP Monitoring Report for the Establishment of IWMC in B. Kamadhoo (Construction Phase)	Maldives	Mar 2019	Submitted to the World Bank and EPA	Ministry of Environment Climate Change and Technology	World Bank	Waste Management	Lead Consultant (Individual)	Report writing, field investigations, compliance assessment, monitoring investigations, consultation with the Island Council etc.
ESMP for the proposed upgrading of Island Waste Management Centre in R. Ungoofaaruu	Maldives	Feb 2019	Cleared by the World Bank and disclosed	Ministry of Environment Climate Change and Technology	World Bank	Waste Management	Lead Consultant (Individual)	Report writing, undertook stakeholder consultations, public/community perception survey, field investigations, impact assessment, devised construction and operational phase mitigation and monitoring plans, Grievance Redress Mechanism etc.

ESMP for the proposed upgrading of Island Waste Management Centre in Lh. Kurendhoo	Maldives	Nov 2018	Cleared by the World Bank, the Maldives EPA and disclosed	Ministry of Environment Climate Change and Technology	World Bank	Waste Management	Lead Consultant (Individual)	Report writing, undertook stakeholder consultations, public/community perception survey, field investigations, impact assessment, devised construction and operational phase mitigation and monitoring plans, Grievance Redress Mechanism etc. Report Link
Operational ESMP for the Regional Waste Management Facility Zone II, Vandhoo, Raa Atoll	Maldives	Nov 2018	Cleared by the World Bank	Ministry of Environment Climate Change and Technology	World Bank	Waste Management / Operational Compliance	Lead Consultant (Individual)	Report writing, developed mitigation and monitoring plan in accordance to the World Bank's EHS standards.
ESMP Monitoring Report for the Establishment of IWMC in Dh. Rinbudhoo (Construction Phase)	Maldives	Aug 2018	Submitted to EPA	Ministry of Environment Climate Change and Technology	Govt of Maldives	Waste Management, Compliance and Monitoring	Lead Consultant (Individual)	Report writing, field investigations, compliance assessment, monitoring investigations, consultation with the Island Council etc.
Environmental Impact Assessment Report for the proposed tourist jetty at Hulhumale'	Maldives	Jul 2018	Cleared by Maldives EPA	Housing Development Corporation	Govt of Maldives	Coastal	Co-Author	Report writing, impact assessment, devised construction and operational phase mitigation and monitoring plans

								Report Link
Environmental Management Plan for the proposed development of Island Waste Management Centre in Dh. Rinbudhoo	Maldives	Jan 2018	Cleared by Maldives EPA and disclosed	Ministry of Environment Climate Change and Technology	Government of Maldives	Waste Management	Lead consultant (Individual)	Report writing, undertook stakeholder consultations, field investigations, impact assessment, devised construction and operational phase mitigation and monitoring plans, Grievance Redress Mechanism etc. Report Link
Environmental Management Plan for the proposed development of Island Waste Management Centre in F. Magoodhoo	Maldives	Dec 2017	Cleared by Maldives EPA and disclosed	Ministry of Environment Climate Change and Technology	Government of Maldives	Waste Management	Lead consultant (Individual)	Report writing, undertook stakeholder consultations, field investigations, impact assessment, devised construction and operational phase mitigation and monitoring plans, Grievance Redress Mechanism etc. Report Link
Environmental Management Plan for the proposed development of Island Waste	Maldives	Sep 2017	Cleared by Maldives EPA and disclosed	Ministry of Environment Climate Change and Technology	Government of Maldives	Waste Management	Lead consultant (Individual)	Report writing, undertook stakeholder consultations, field investigations, impact assessment, devised construction and operational phase mitigation and

Management Centre in Th. Vandhoo								monitoring plans, Grievance Redress Mechanism etc. Report Link
Environmental and Social Assessment and Management Framework (ESAMF) and Resettlement Policy Framework of MCEP	Maldives	Nov 2016	Cleared by the World Bank and disclosed	World Bank	World Bank	Environmental and social assessment and management framework and resettlement policy framework	Support Staff (Voluntary)	Carried out atoll-based stakeholder consultations in Zone 4&5. Wrote stakeholder engagement chapter Report Link
Connected with Water: Integrated and Adaptive Water Management Framework for South East Queensland	Australia	May 2015	N/A	Griffith University	N/A	Studio Assignment	Co-Author	Literature review, development of programmes, plans and activities, stakeholder consultations, report writing etc. News Link
Urban Analysis of Brisbane CDE	Australia	2015	N/A	Griffith University	N/A	Studio Assignment	Co-Author	Literature review, field investigations, public consultations, report writing etc.
Feasibility Study for Low Density Residential	Australia	2015	N/A	Griffith University	N/A	Studio Assignment	Co-Author	Literature review, field investigations, public consultations, report writing etc.

Development in Park Ridge Queensland								
Environment Impact Assessment Regulations 2012	Maldives	2012	N/A	Ministry of Environment Climate Change and Technology	Government of Maldives	Legal/Environmental Assessment/Conservation	Support Staff / Drafting of Regulation	Supported in drafting the EIA regulation 2012. Link to Regulation
Standards on Biodegradable Plastic Bags 2012	Maldives	2011	N/A	Ministry of Environment Climate Change and Technology	Government of Maldives	Legal	Formulation / Drafting of Standard	Drafting of the standard
Effects of leachates on the quality of ground water	India	2010	N/A	University of Mysore	N/A	Bachelor of Science Dissertation	Author	Field investigations, water quality analysis and assessments, data analysis and interpretations, findings and recommendations etc.

Note: Ministry of Environment, Climate Change and Technology (MoECCT) was formerly known as Ministry of Environment (ME), Ministry of Environment and Energy (MEE), and Ministry of Housing and Environment (MHE), Ministry of Housing, Transport and Environment (MHTE) etc.

8. REFEREES FOR EDUCATION

- Professor Darryl LOW CHOY
Professor – Environment and Landscape Planning
Urban Research Program

Head of Discipline (Planning)
School of Environment
Griffith University
Brisbane, QLD 4111 Australia

Program Co-Leader
Program B: Waster Sensitive Urbanism
Cooperative Research Centre for Water Sensitive Cities
E: d.lowchoy@griffith.edu.au
- Dr Tooran Alizadeh
Lecturer, Urban & Environmental Planning
Griffith School of Environment
Griffith University
Brisbane, QLD 4111 Australia
E: t.alizadeh@griffith.edu.au

9. AUTHORIZATION

I, the undersigned, certify that to the best of my knowledge and belief, this CV correctly describes myself, my qualifications, and my experience

Ahmed Hassaan Zuhair (National ID: A073471)



8 June 2023

ANNEX 6

Study Area Map in A3 Scale



LEGEND:

- POWER DISTRIBUTION BOX
- IWRMC
- EXISTING POWERHOUSE
- NEW RO PLANT BUILDING
- NEW POWERHOUSE
- RESIDENTIAL AREA
- PUBLIC AREA

PREPARED BY

PROJECT
CONSTRUCTION OF ISLAND WASTE MANAGEMENT CENTRE
TH.MADIFUSHI

DESIGN BY

AMENDMENTS

TITLE
STUDY AREA MAP

STRUCTURE BY

CLIENT DEPARTMENT
WMPC DEPARTMENT

DRAWN BY
MA

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PAGE NO. 01

SCALE	1:2000
DWG NO.	MADISAP-A1-01
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ANNEX 7

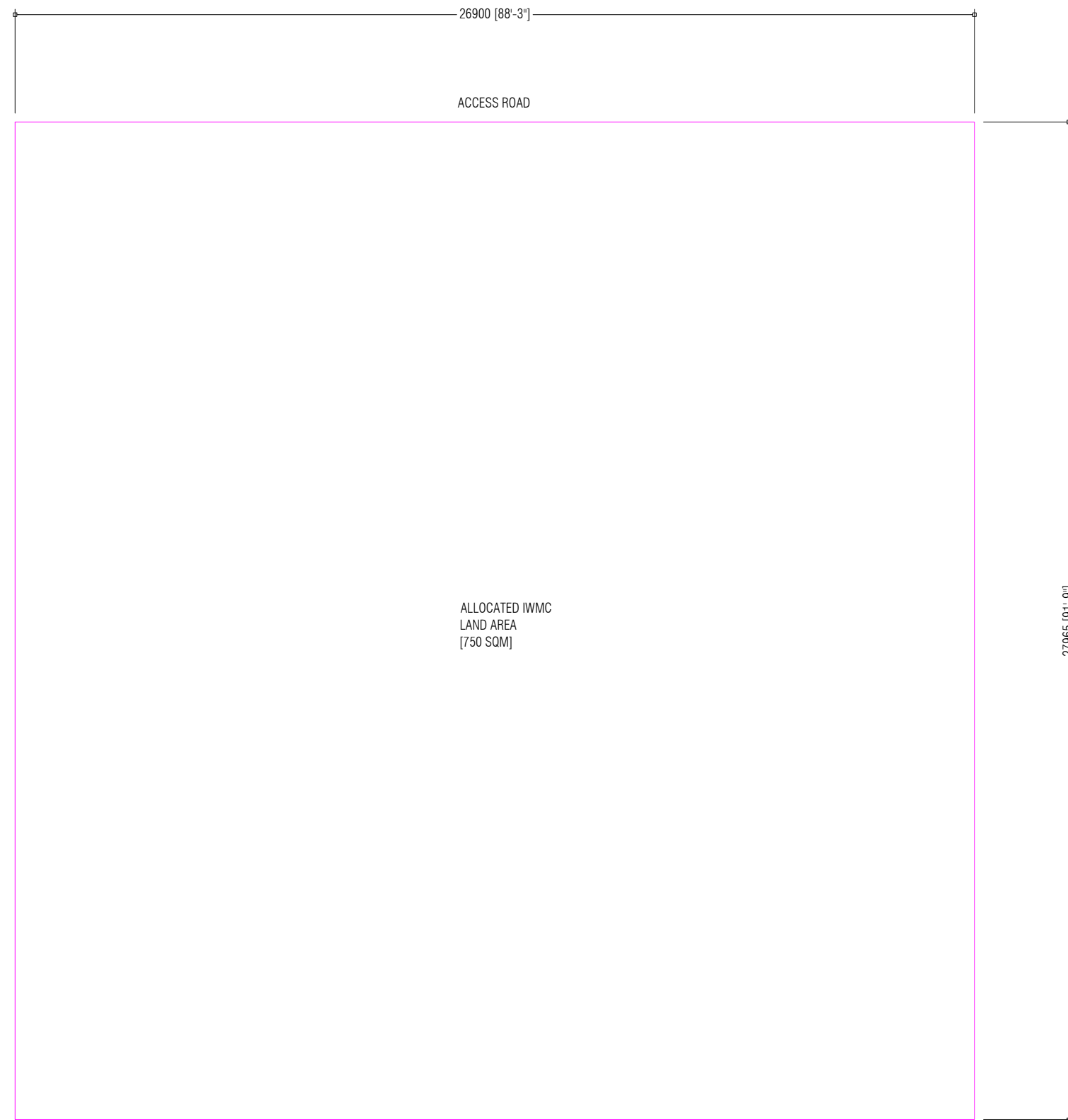
Project Design and Engineering Drawing Set


CONSTRUCTION OF TH.MADIFUSHI
ISLAND WASTE MANAGEMENT CENTRE

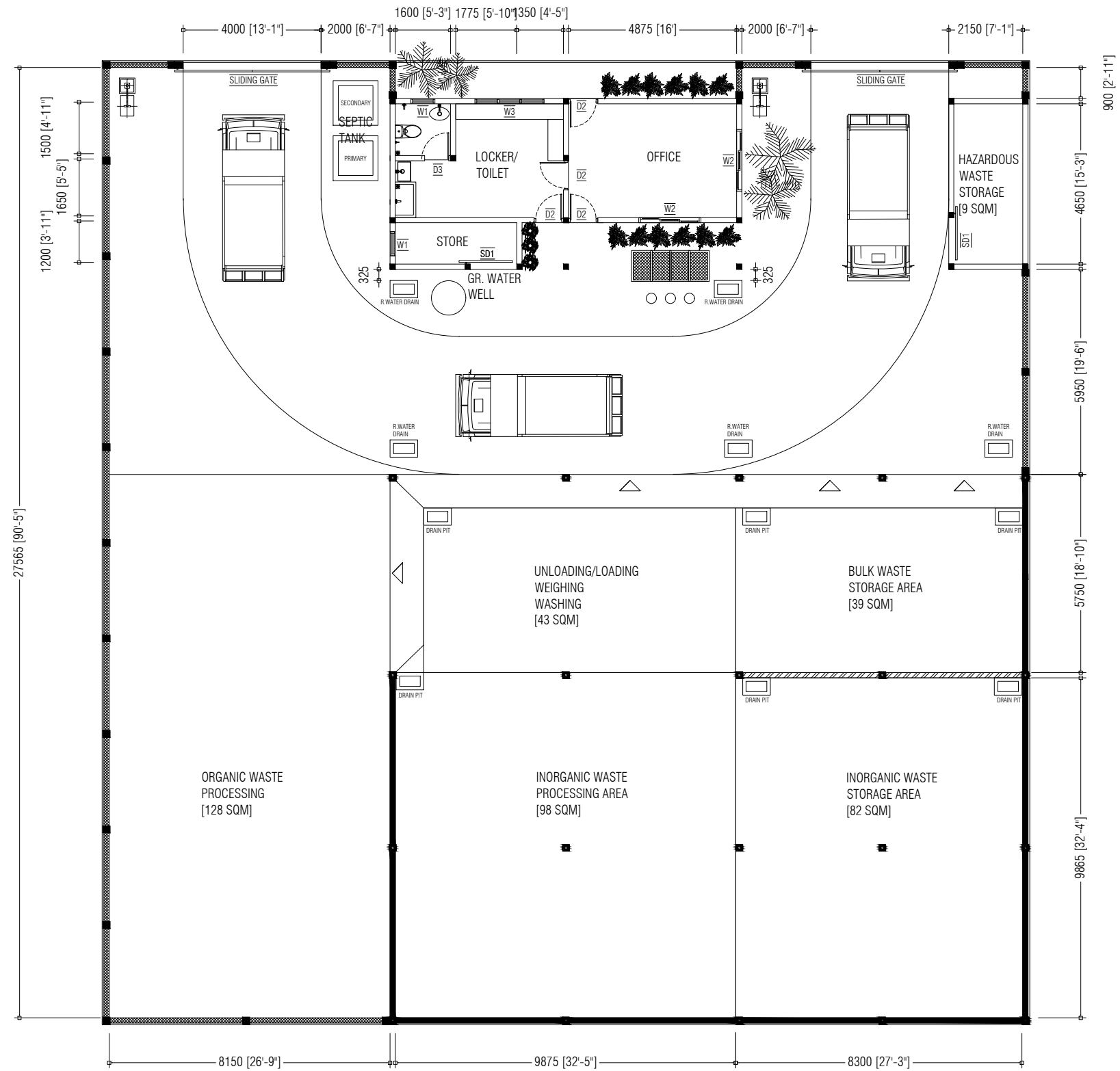


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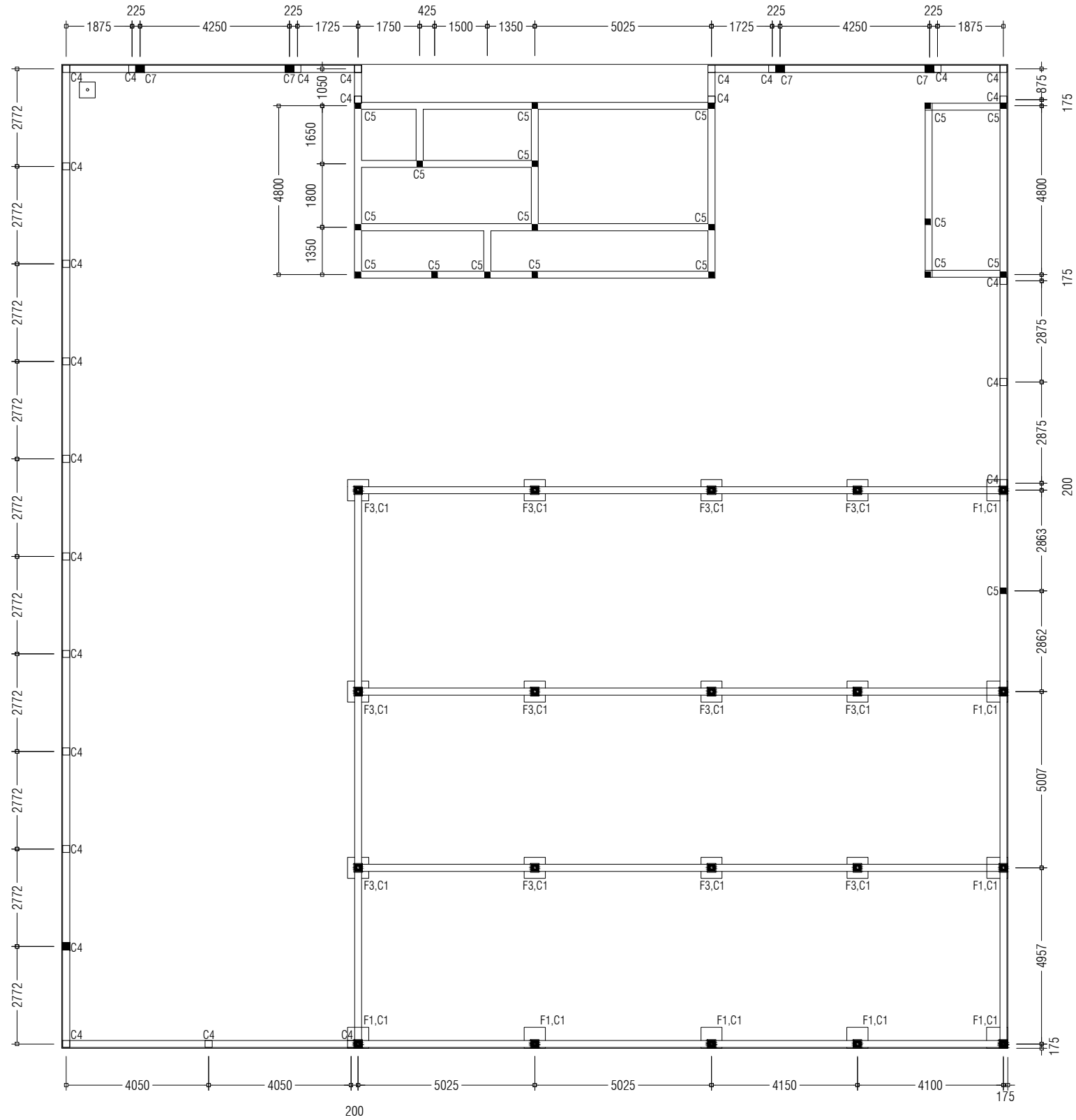
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	TITLE	STRUCTURE BY	
	LOCATION PLAN	AFRAZ	
	CLIENT DEPARTMENT	DRAWN BY	
	WMPC DEPARTMENT	AFRAZ	
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	PAGE NO. 01	DWG NO.	MADI-A1-01
	DATE	19.10.2020	



NOTE:

- 600mm HEIGHT WALL + 2m HEIGHT CLADDING ON TOP
- OFFICE / HAZARDOUS WASTE BUILDING WALLS
- 600mm HEIGHT MASONRY WALL + FULL HEIGHT CLADDING ON TOP
- BOUNDARY WALLS

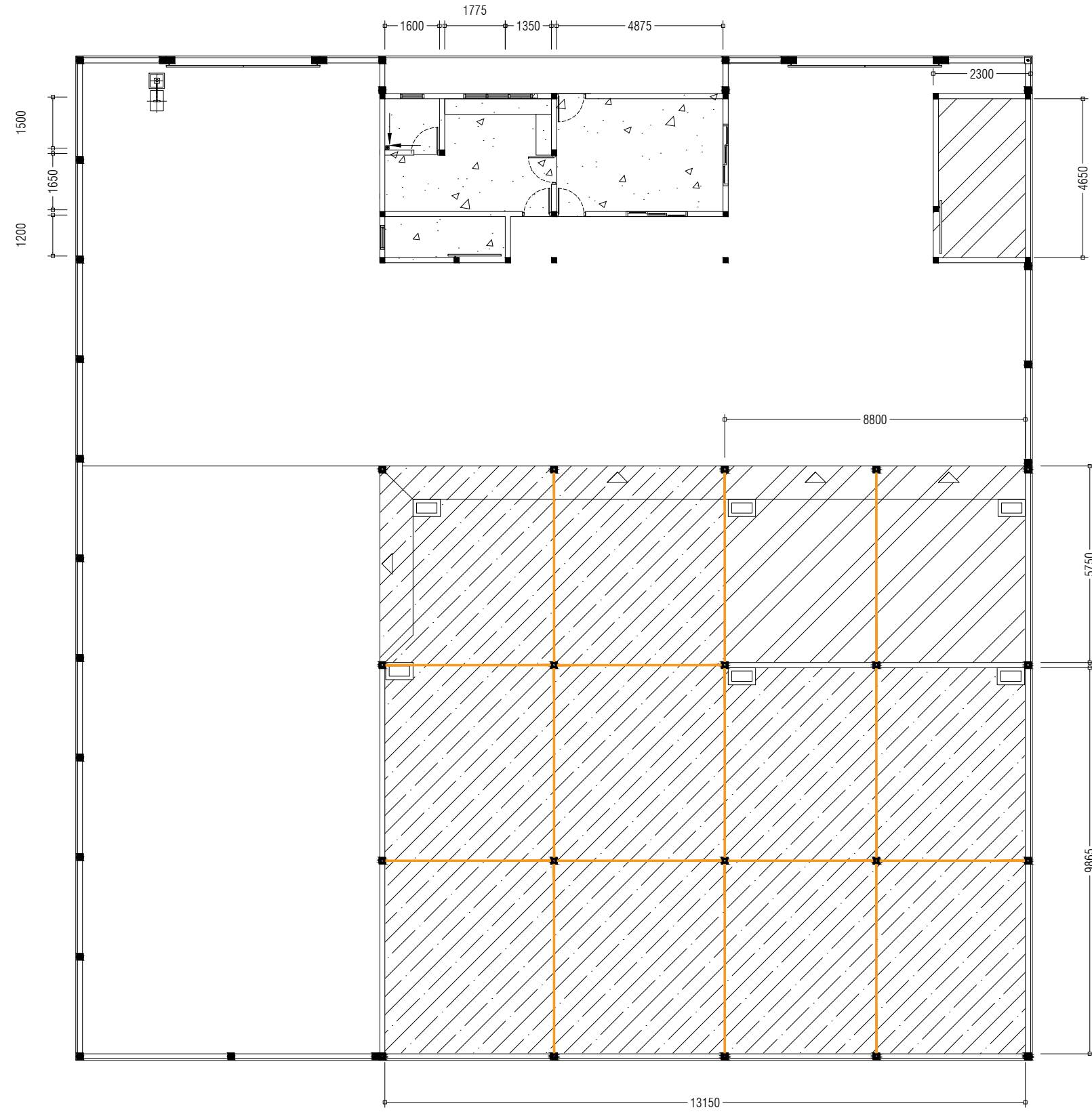
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	CONSTRUCTION OF ISLAND WASTE MANAGEMENT CENTRE TH.MADIFUSHI	AFRAZ	FOOTING AND COLUMN STUMP CHANGED FOR GI PIPE COLUMN TO BE BOLTED WALL HEIGHTS AMENDED
	TITLE	STRUCTURE BY	
	FLOOR PLAN	AFRAZ	
	CLIENT DEPARTMENT	DRAWN BY	
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PAGE NO. 02	DWG NO. MADI-A1-02(R)		
	DATE 17.03.2021		



NOTE:

- TIE BEAMS [200X200mm]
- LAMP POST FOOTING [450X450mm]

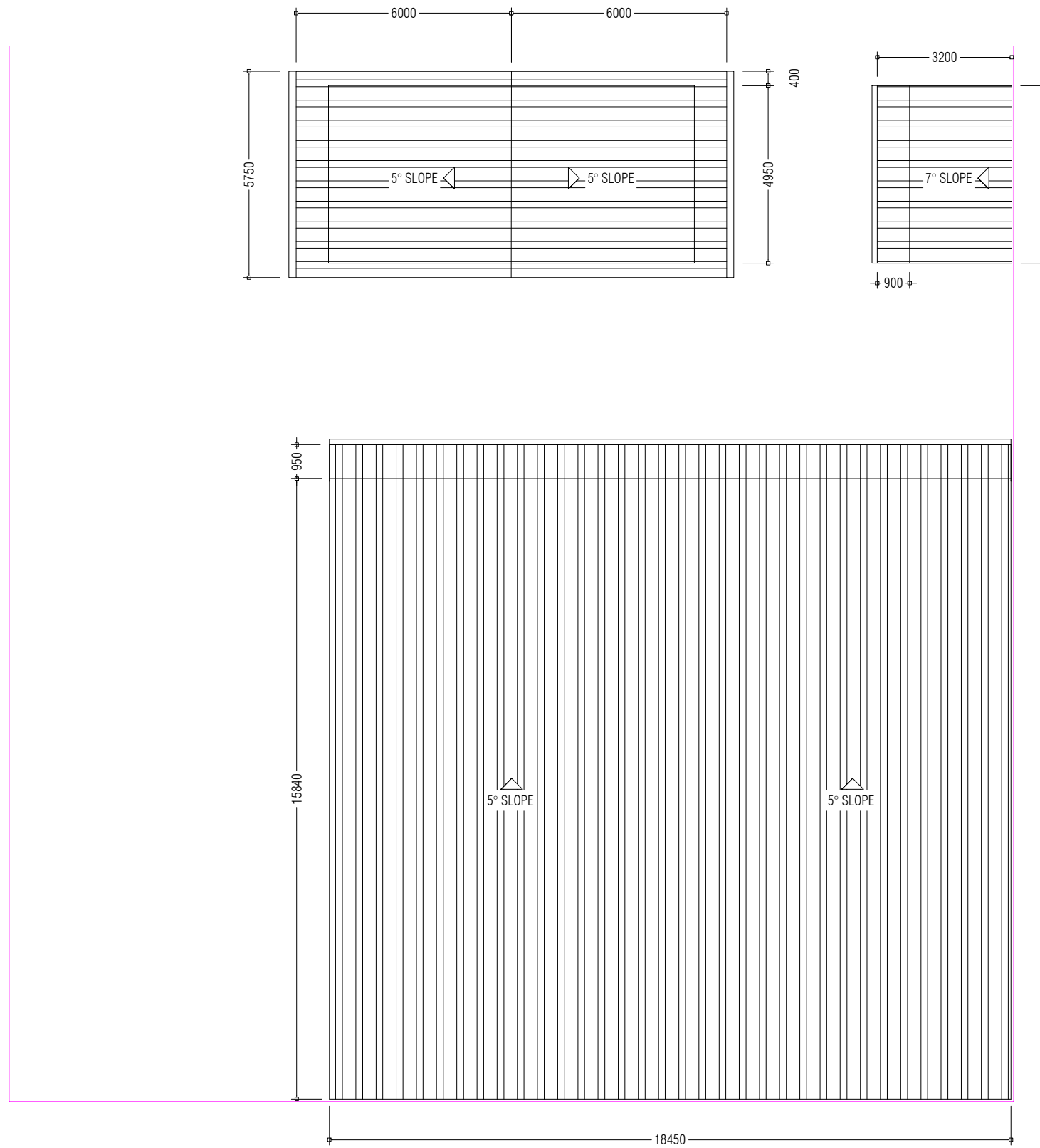
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	CONSTRUCTION OF ISLAND WASTE MANAGEMENT CENTRE TH.MADIFUSHI	AFRAZ	FOOTING AND COLUMN STUMP CHANGED FOR GI PIPE COLUMN TO BE BOLTED
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	FOUNDATION PLAN	AFRAZ	
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NOTE:

- 75mm FLOOR SLAB
- 100mm FLOOR SLAB
- 150mm FLOOR SLAB
- EXPANSION JOINTS

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	CONSTRUCTION OF ISLAND WASTE MANAGEMENT CENTRE TH.MADIFUSHI	AFRAZ	SLAB THICKNESS REVISED EXPANSION JOINTS ADDED
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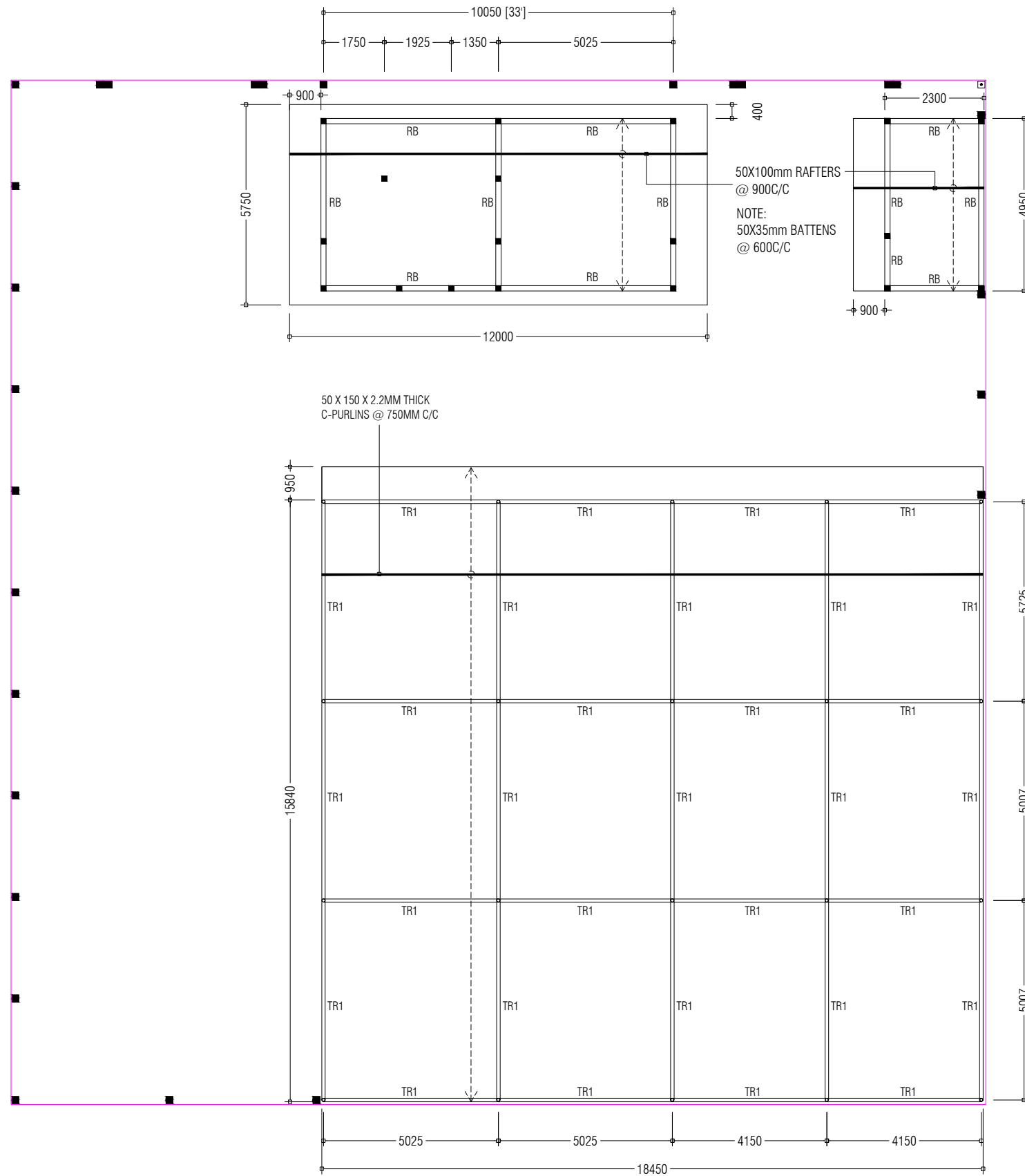
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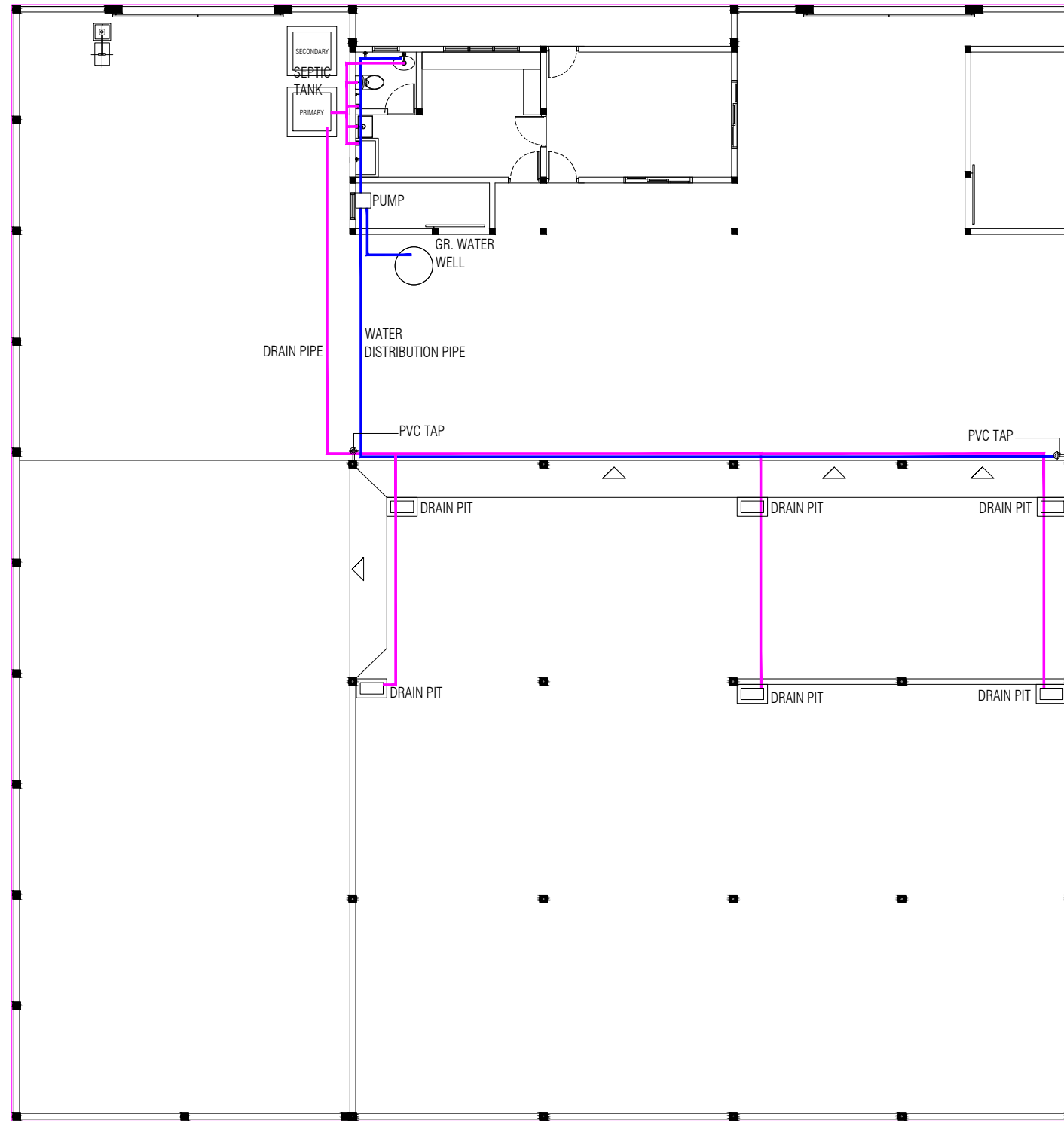


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	CLIENT DEPARTMENT WMPC DEPARTMENT	DRAWN BY AFRAZ	
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PLUMBING PLAN

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WMPC DEPARTMENT

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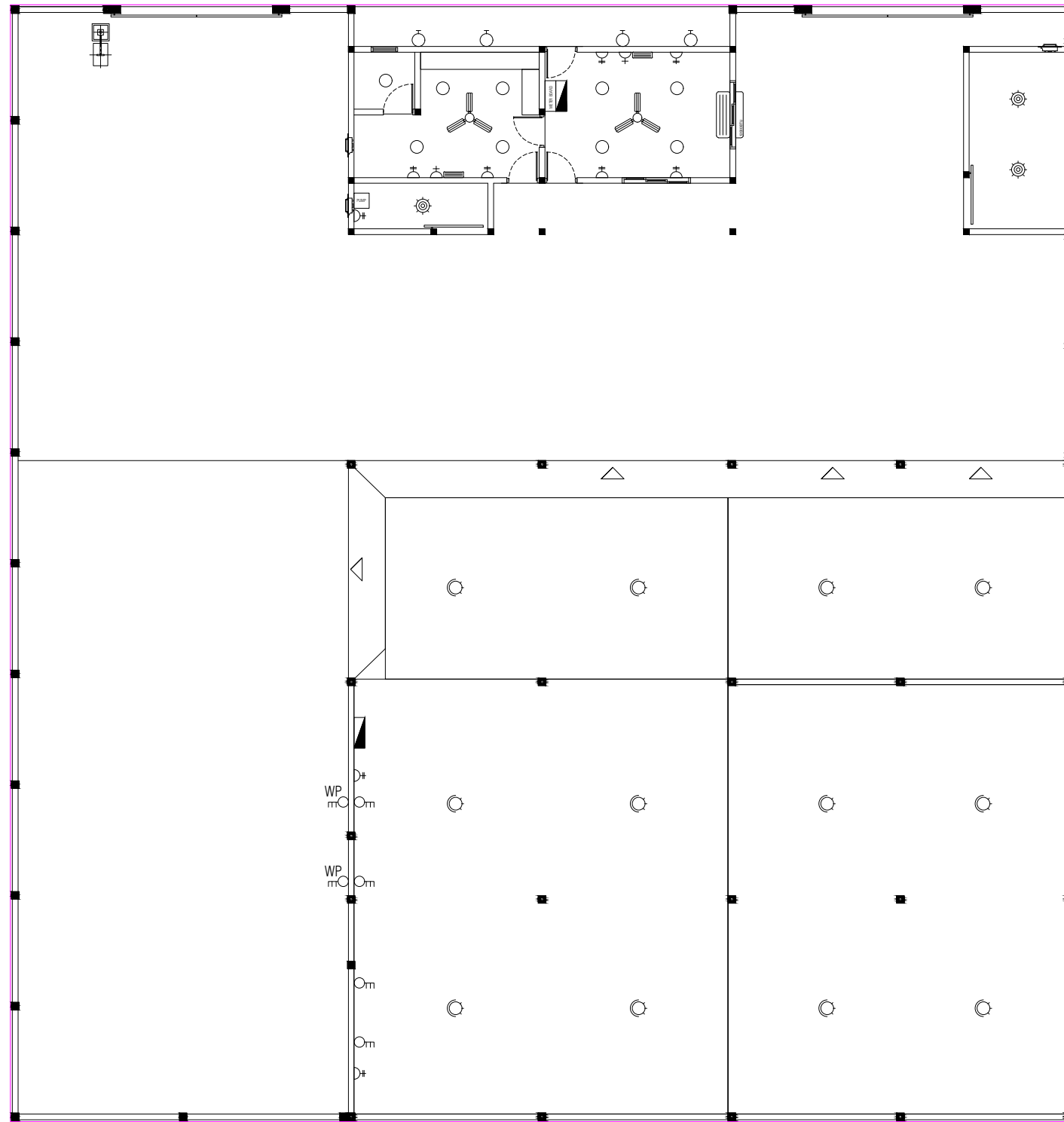
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









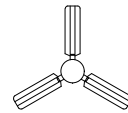


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- METER BOARD 
- DISTRIBUTION BOARDS 
- 20W LED LIGHT (DAY LIGHT) 
- 20W CEILING MOUNT LED LIGHT (WARM WHITE) 
- 20W WALL MOUNT EXTERIOR LED LIGHT (WARM WHITE) 
- 25W SWIVEL LED FLOOD LIGHT (DAY LIGHT) 
- 10W WALL MOUNT LED EMERGENCY LIGHT (DAY LIGHT) 
- 13AMP DOUBLE SOCKET 
- 3 PHASE, 15A POWER POINTS [1.5m ABOVE FL. LEVEL] 
- 3 PHASE, WATERPROOF, 15A POWER POINTS [1.5m ABOVE FL. LEVEL] 
- CEILING FAN 
- EXHAUST FAN 
- AC WITH OUTLET [12,000 BTU] 

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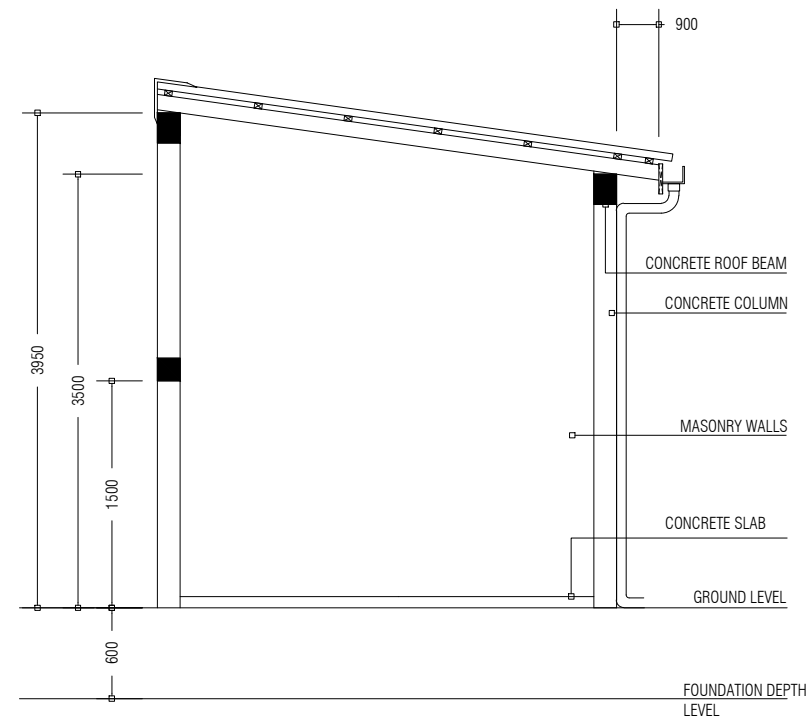
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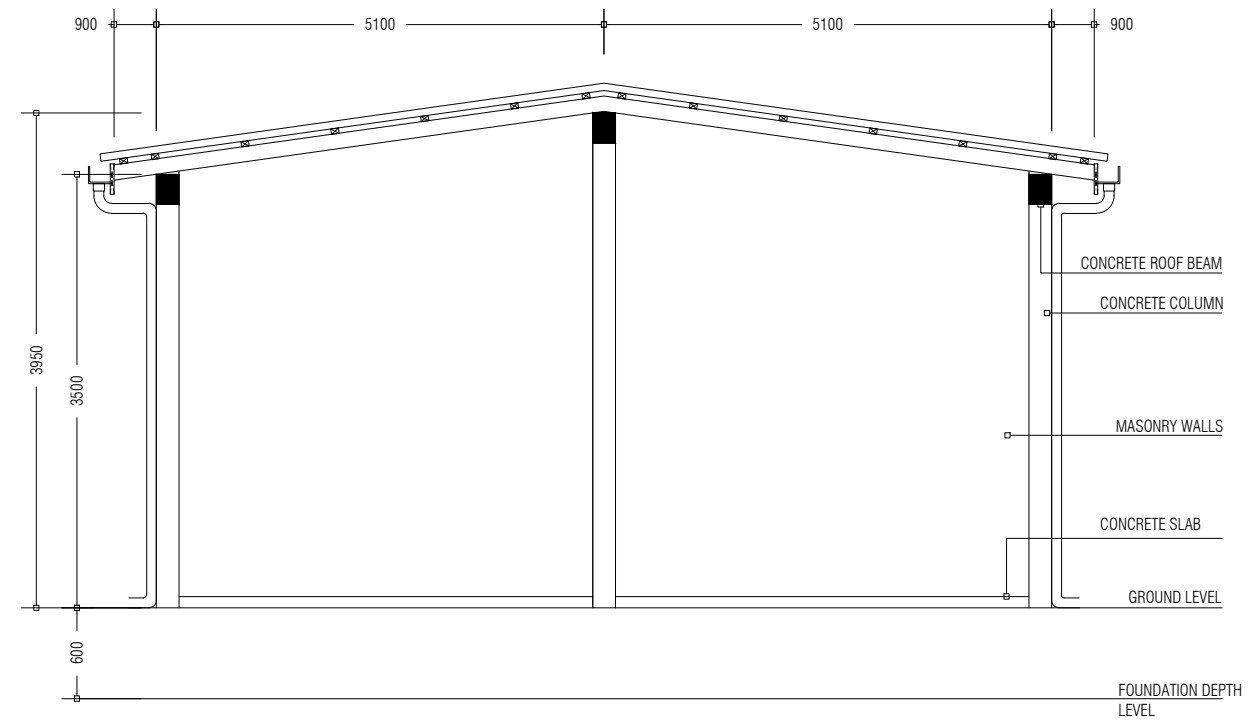
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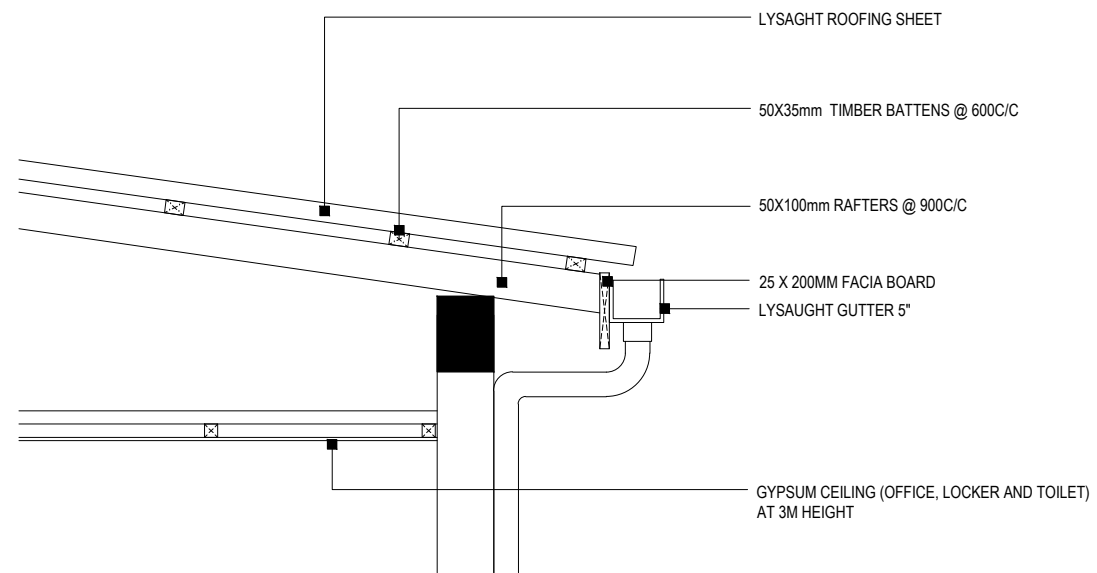
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OFFICE / LOCKER BUILDING ELEVATION

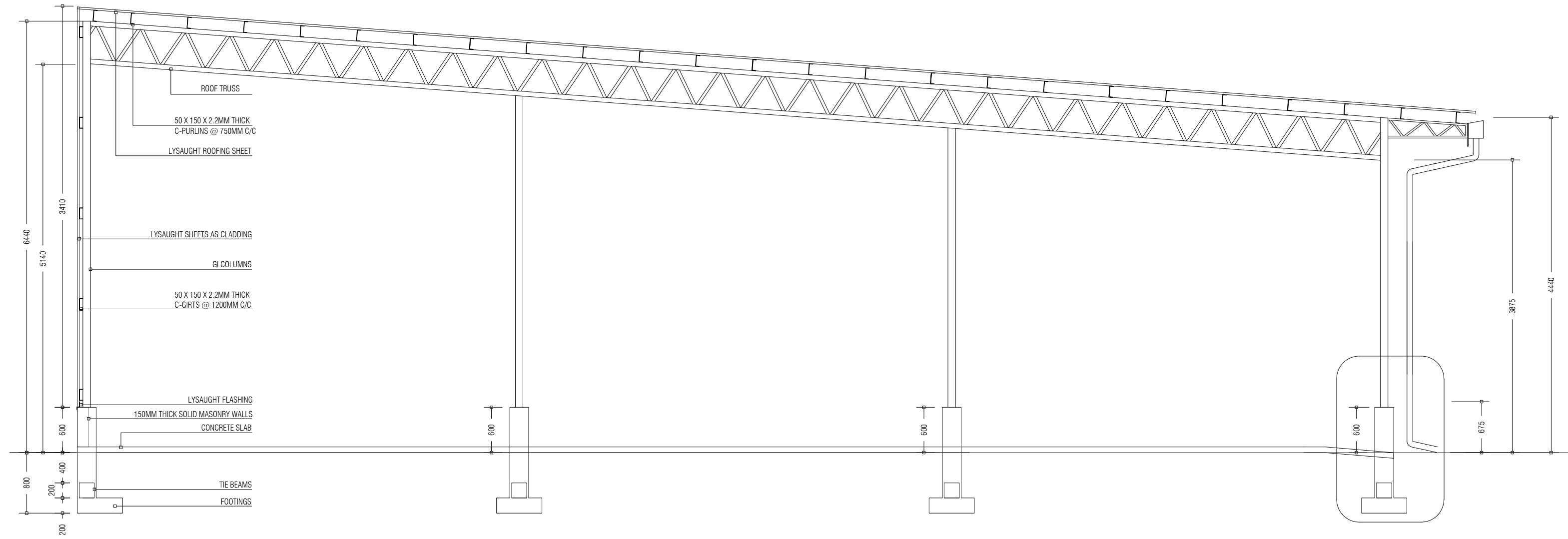


OFFICE / LOCKER BUILDING SECTION




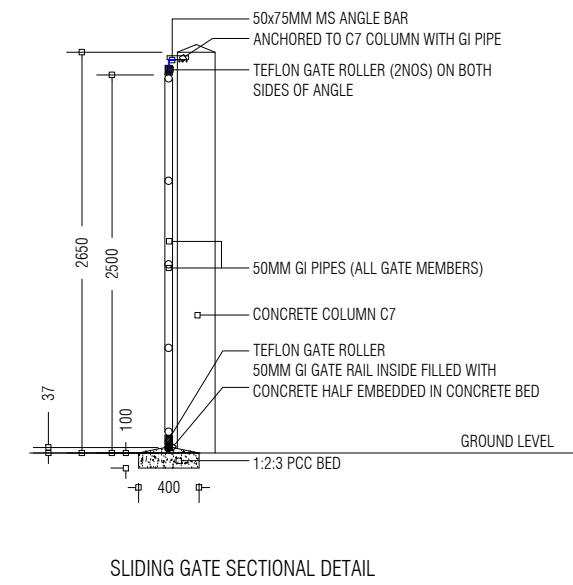
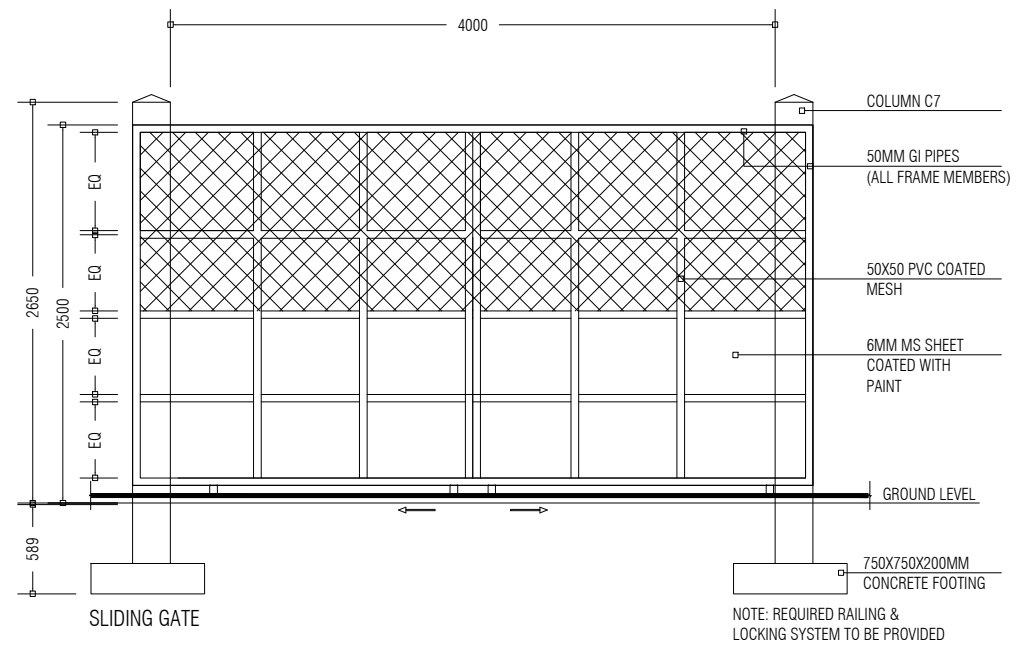
ROOF DETAIL

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	TITLE ELEVATIONS AND SECTIONS	STRUCTURE BY AFRAZ	
	CLIENT DEPARTMENT WMPC DEPARTMENT	DRAWN BY AFRAZ	
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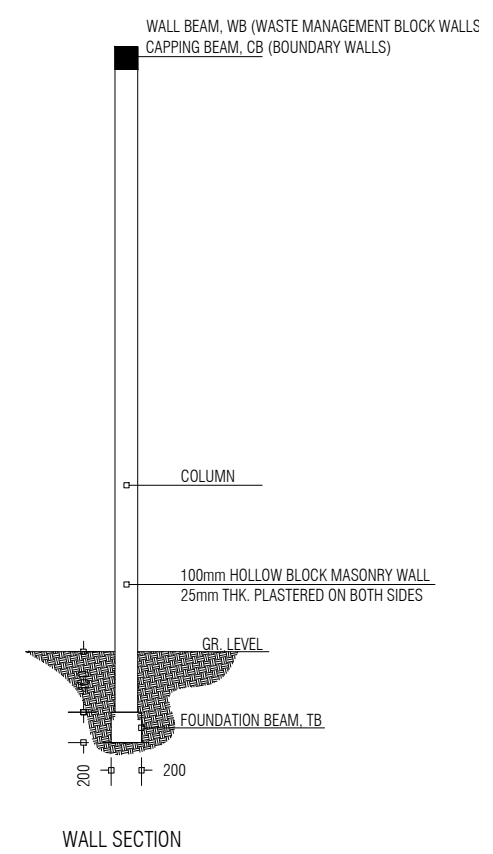
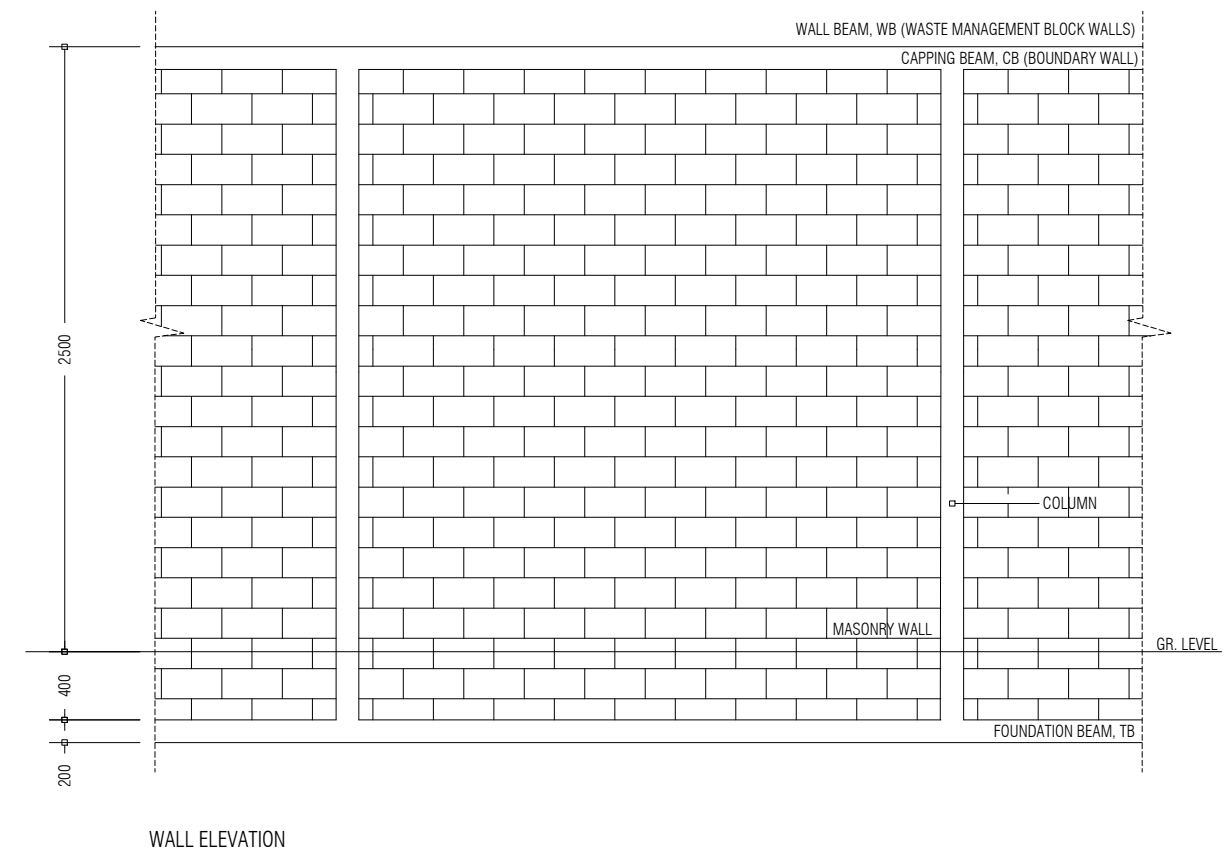



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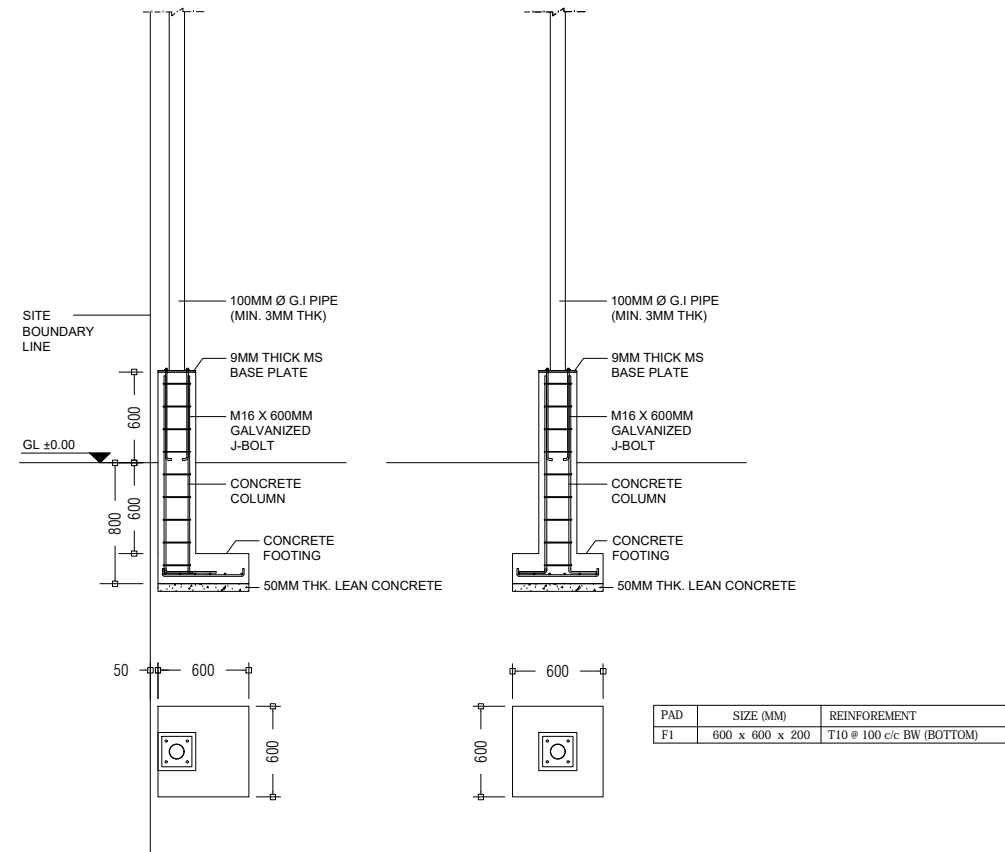
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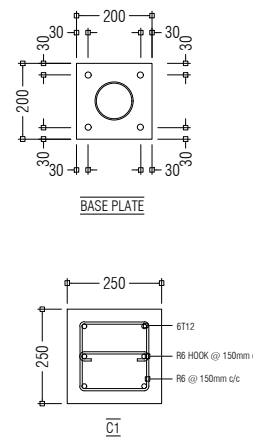
NOTE:
ALL WELDS FOR THE
GI MEMBERS ARE
5mm FILLET WELDS




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	ELEVATION AND SECTIONS: GATE DETAILS, WALL DETAILS	AFRAZ	
	CLIENT DEPARTMENT	DRAWN BY	
	WMPC DEPARTMENT	AFRAZ	
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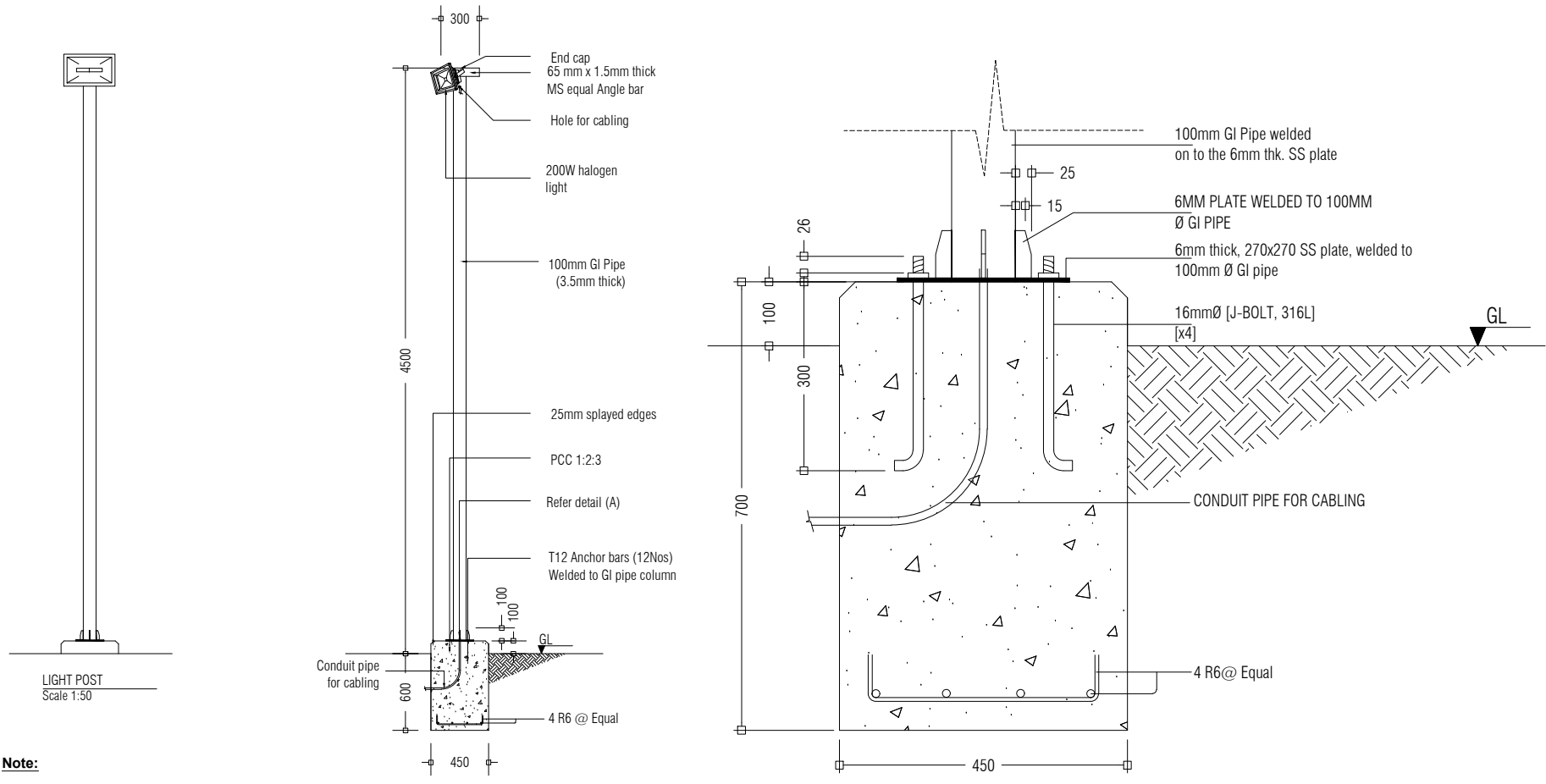


FOOTING DETAILS 1:50



BASE PLATE AND COLUMN DETAILS 1:20

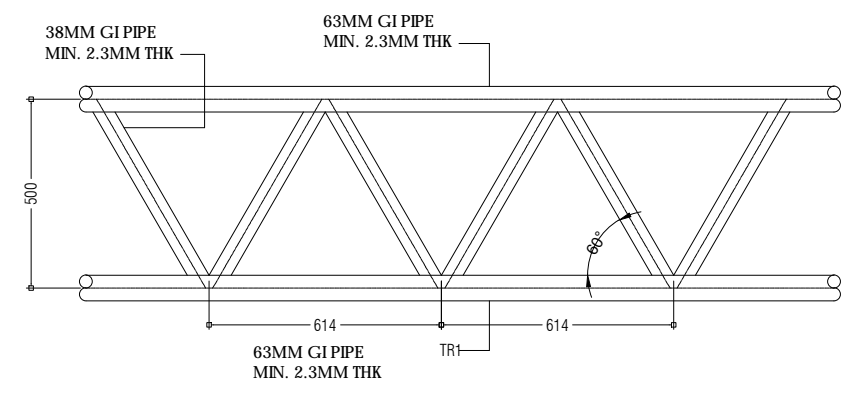
PREPARED BY  MCEP MINISTRY OF ENVIRONMENT GREEN BUILDING, HANDHUVAREE HIGUN, MAAFANNU, MALÉ (20392), REPUBLIC OF MALDIVES, TEL: +960-3018431, +960-3018300, FAX: +960-328301	PROJECT	DESIGN BY	AMENDMENTS
	CONSTRUCTION OF ISLAND WASTE MANAGEMENT CENTRE TH.MADIFUSHI	AFRAZ	FOOTING AND COLUMN STUMP CHANGED FOR GI PIPE COLUMN TO BE BOLTED
	TITLE	STRUCTURE BY	
	FOOTING DETAILS	AFRAZ	
	CLIENT DEPARTMENT	DRAWN BY	
	WMPC DEPARTMENT	AFRAZ	
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PAGE NO. 12	DWG NO. MADI-D1-12(R)		
	DATE 17.03.2021		



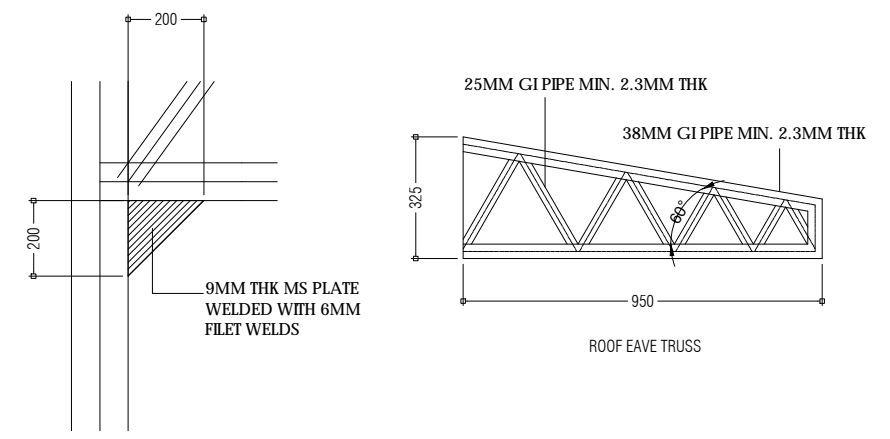
LIGHT POST DETAIL
Scale 1:50

LIGHT POST FOUNDATION FOOTING DETAIL 1:10

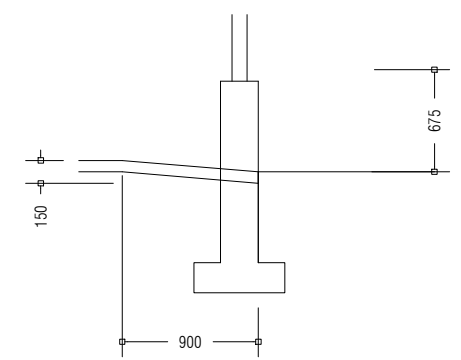
Note:
 * Concrete cover: 50mm
 * GI pipe to be painted with 1 coat of sealer & 2 coats of finishing paint.
 (Sigma or equivalent, maroon colour)



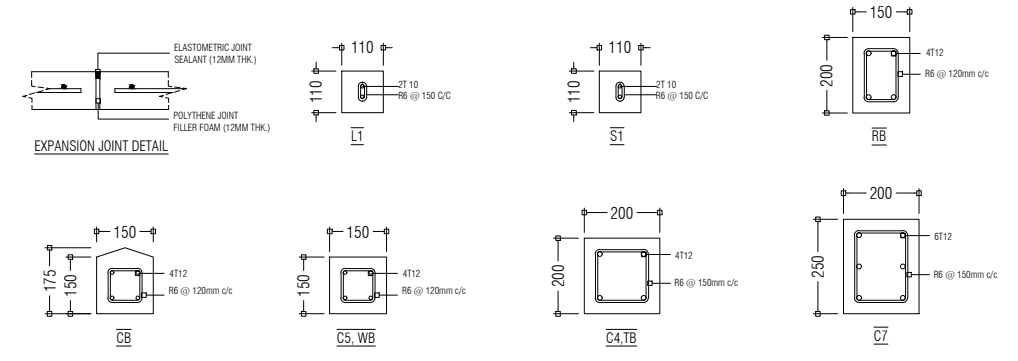
TRUSS DETAIL 1:20



COLUMN AND TRUSS CONNECTION DETAIL 1:20




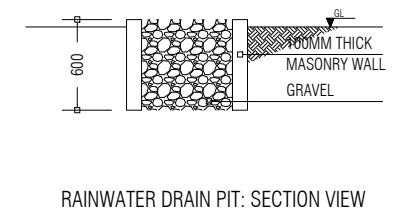
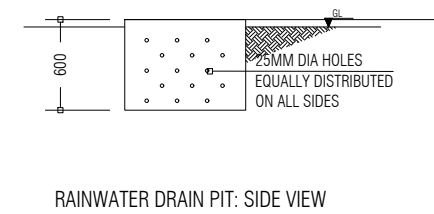
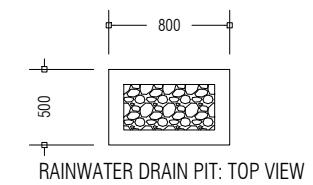
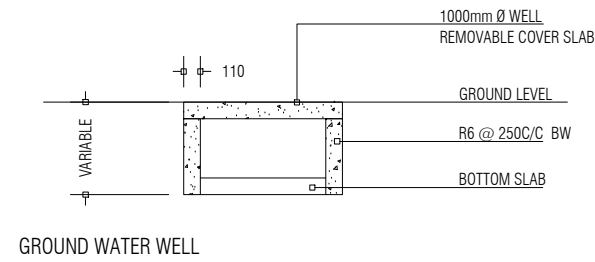
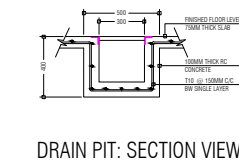
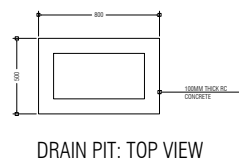
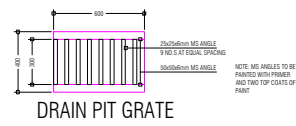
DETAIL A: RAMP DETAIL 1:50



COLUMN, BEAM AND EXPANSION JOINT DETAILS 1:20

CONCRETE COVERS:
 BEAMS AND COLUMNS: 30mm
 75MM SLAB: 30mm
 100MM SLAB: 40mm
 150MM SLAB: 40mm
 NOTE:
 1. RB/WB TO BE CAST ON TOP OF MASONRY WALLS
 2. MASONRY WALLS TO BE PLACED ON TB

PREPARED BY	PROJECT	DESIGN BY	AMENDMENTS
 MCEP MINISTRY OF ENVIRONMENT GREEN BUILDING, HANDHUVAREE HIGUN, MAAFANNU, MALE' (20392), REPUBLIC OF MALDIVES, TEL: +960-3018431, +960-3018300, FAX: +960-328301	CONSTRUCTION OF ISLAND WASTE MANAGEMENT CENTRE TH.MADIFUSHI	AFRAZ	FOOTING AND COLUMN STUMP CHANGED FOR GI PIPE COLUMN TO BE BOLTED EXPANSION JOINT DETAILS ADDED
	TITLE	STRUCTURE BY	ROOF EAVE TRUSS DETAILS ADDED
	STRUCTURAL DETAILS	AFRAZ	
	CLIENT DEPARTMENT	DRAWN BY	
WMPC DEPARTMENT	AFRAZ		
PAPER SIZE A3	SCALE	1:50, 1:20, 1:10	
PAGE NO. 13	DWG NO.	MADI-D1-13(R2)	
	DATE	17.03.2021	



PREPARED BY

PROJECT
CONSTRUCTION OF ISLAND WASTE MANAGEMENT CENTRE
TH.MADIFUSHI

DESIGN BY
AFRAZ

AMENDMENTS



TITLE
GROUND WATER WELL, RAINWATER DRAIN PIT AND WASTE MANAGEMENT BUILDING
DRAIN PIT DETAILS

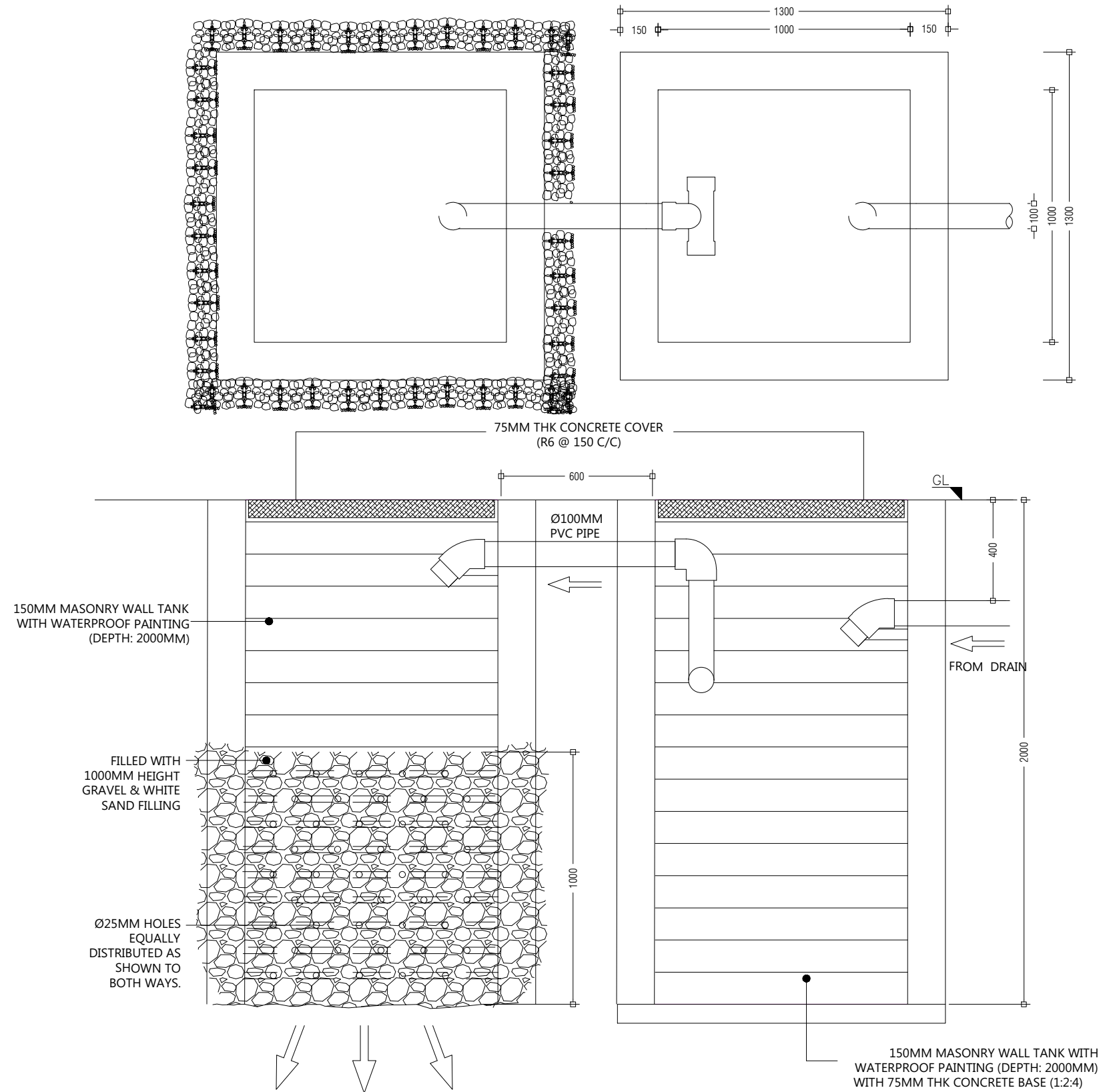
CLIENT DEPARTMENT
WMPC DEPARTMENT

STRUCTURE BY
AFRAZ

DRAWN BY
AFRAZ

PAPER SIZE A3
PAGE NO. 14

SCALE 1:50
DWG NO. MADI-D1-14
DATE 19.10.2020



PREPARED BY

PROJECT
CONSTRUCTION OF ISLAND WASTE MANAGEMENT CENTRE
TH.MADIFUSHI

DESIGN BY
AFRAZ

AMENDMENTS

TITLE
SEPTIC TANK DETAILS

STRUCTURE BY
AFRAZ

CLIENT DEPARTMENT
WMPC DEPARTMENT

DRAWN BY
AFRAZ

PAPER SIZE A3

SCALE 1:50

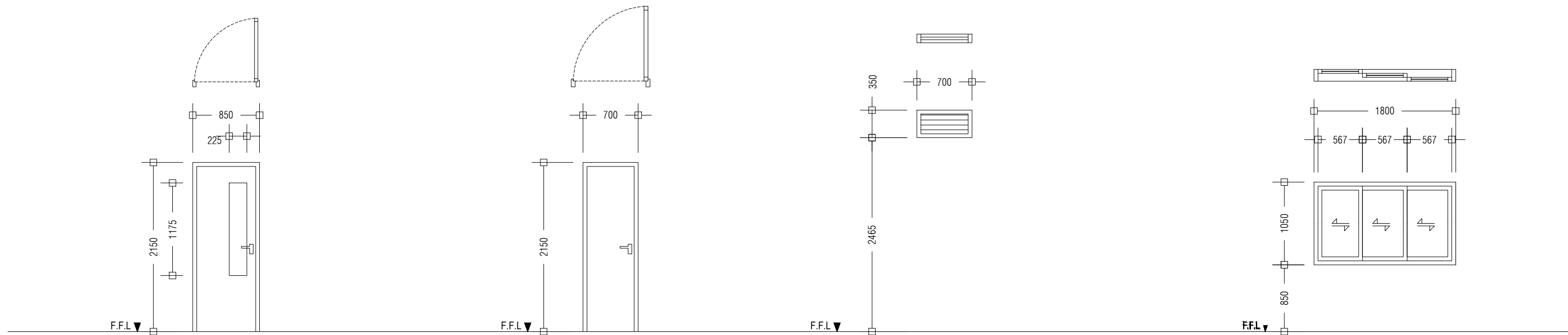
PAGE NO. 15

DWG NO. MADI-D1-15

DATE 19.10.2020



MCEP
MINISTRY OF ENVIRONMENT
GREEN BUILDING, HANDHUVAREE HIGUN,
MAAFANNU, MALÉ (20392), REPUBLIC OF MALDIVES,
TEL: +960-3018431, +960-3018300, FAX: +960-328301

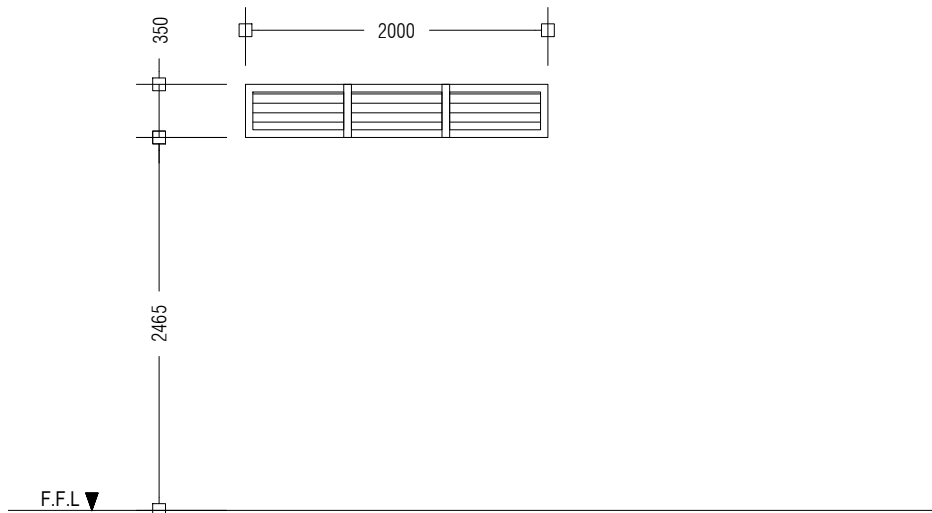


D2	SWING TYPE DOOR
REMARKS	ALUMINUM DOOR WITH CLEAR GLASS PANEL 01 DOOR KNOB WITH LOCK SET 04 HINGES DOOR STOPPER, FINISHED WITH WHITE COATED PAINT
LOCATION	GROUND FLOOR
QUANTITY	NO.S 04
OPEN AREA	1.83 m ²

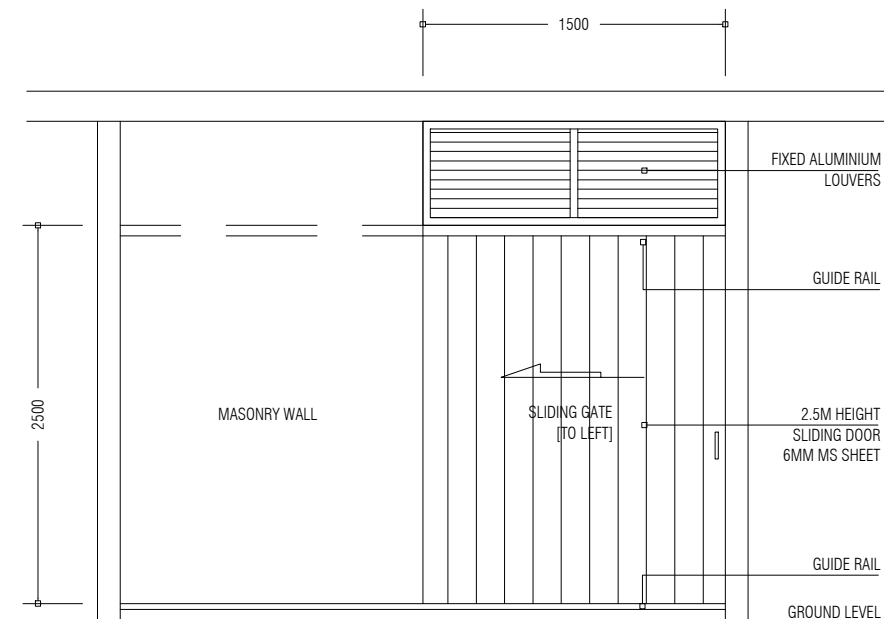
D3	SWING TYPE DOOR
REMARKS	ALUMINIUM DOOR WITH DOOR KNOB AND 1 LOCK SET 04 HINGES
LOCATION	GROUND FLOOR
QUANTITY	NO.S 01
OPEN AREA	1.51m ²

W1	ALUNINIUM LOUVER WINDOW
REMARKS	ALUMINUM FRAMED, ALUMINIUM LOUVERED, FINISHED WITH WHITE COATED PAINT
LOCATION	GROUND FLOOR
QUANTITY	NO.S 2
OPEN AREA	0.25 m ²

W2	ALUMINIUM SLIDING WINDOW
REMARKS	ALUMINUM FRAMED, TINTED BLACK GLASS, FINISHED WITH WHITE POWDER COATED PAINT
LOCATION	GROUND FLOOR
QUANTITY	NO.S 02
OPEN AREA	1.89 m ²



W3	ALUNINIUM LOUVER WINDOW
REMARKS	ALUMINUM FRAMED, ALUMINIUM LOUVERED, FINISHED WITH WHITE COATED PAINT
LOCATION	GROUND FLOOR
QUANTITY	NO.S 1
OPEN AREA	0.75 m ²



HAZADIOUS WASTE / STORE SD1

PREPARED BY	PROJECT	DESIGN BY	AMENDMENTS
	CONSTRUCTION OF ISLAND WASTE MANAGEMENT CENTRE TH.MADIFUSHI	AFRAZ	
	TITLE	STRUCTURE BY	
	DOOR AND WINDOW SCHEDULE	AFRAZ	
	CLIENT DEPARTMENT	DRAWN BY	
	WMPC DEPARTMENT	AFRAZ	
PAPER SIZE	A3	SCALE	1:50
PAGE NO.	16	DWG NO.	MADI-A2-16
		DATE	19.10.2020

ANNEX 8

Commitment for Mitigation and Monitoring

بِسْمِ اللّٰهِ الرَّحْمٰنِ الرَّحِیْمِ



Ministry of Environment, Climate Change and Technology
Male', Republic of Maldives

Date: 8 June 2023

No: 438-WMPC/438/2023/52

Mr. Ibrahim Naeem,
Director General,
Environmental Protection Agency,
Green Building, Handhuvaree Hingun, Maafannu,
Male', 20392, Maldives.

Dear Sir,

Sub: Commitment to undertake Mitigation and Environmental Monitoring

The Environmental and Social Management Plan (ESMP) prepared for the proposed establishment of the Island Waste and Resource Management Centre (IWRMC) in Th. Madifushi has been prepared in accordance with the EIA Regulations 2012 and its amendments, issued by the Ministry of Environment.

We would like to confirm our commitment to the proposed mitigation measures and the monitoring programme that has been highlighted in the ESMP report prepared for the above referenced project.

Sincerely,

Ahmed Murthaza,
Director General

ANNEX 9

Contact Details of Stakeholders Consulted

List of Stakeholders Consulted

Institution	Name	Phone	Email
MNPHI	Anoosha Hashim	7509191	anoosha.hashim@planning.gov.mv
	Hawwa Ageela	7765636	hawwa.ageela@planning.gov.mv
	Nihaaza Anees	9551992	nihaaza.anees@planning.gov.mv
MLSA	Ahmed Shaniu	7789989	ahmed.shaniu@mlsa.gov.mv
Madifushi Council	Ahmed Nasheeth	7681300	info@madifushi.gov.mv
	Hassan Thasneem	7699771	
	Mohamed Shinaan	7926566	

ESMP Report of Th. Madifushi IWRMC project

Ahmed Hassaan <ahmed.hassaan@environment.gov.mv>

Sun 6/11/2023 11:14 AM

To: info@thaa.gov.mv <info@thaa.gov.mv>; info@madifushi.gov.mv <info@madifushi.gov.mv>

Cc: MCEP | Min. of Environment, Climate Change and Technology MV <mcep@environment.gov.mv>

📎 1 attachments (10 MB)

ESMP_Th. Madifushi IWRMC (June 2023).pdf;

Dear Sir/Madam,

For your reference, please find attached the Environmental and Social Management Plan (ESMP) report prepared for the proposed Establishment of Island Waste and Resource Management Centre (IWRMC) in Th. Madifushi.

The report will be submitted to EPA for review and clearance today.

Best Regards,

Ahmed Hassaan Zuhair
Environmental and Social Safeguards Specialist
Maldives Clean Environment Project
Ministry of Environment, Climate Change and Technology



Ministry of Environment, Climate Change and Technology, Ameenee Magu, Maafannu, Male', 20392, Maldives.

Office (Direct): +(960) 3018446 | Office (PABX): +(960) 3018300 | Fax: +(960) 3018301

Email: ahmed.hassaan@environment.gov.mv | Web: www.environment.gov.mv

Find us on Facebook: <https://www.facebook.com/MCEP.mv/>

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ANNEX 10

Additional Information Requested by EPA

ADDITIONAL INFORMATION FOR EPA
ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN
FOR THE PROPOSED ESTABLISHMENT OF AN ISLAND
WASTE AND RESOURCE MANAGEMENT CENTRE IN TH.
MADIFUSHI

PREPARED FOR
MINISTRY OF ENVIRONMENT

PREPARED BY
AHMED HASSAAN ZUHAIR

JUNE 2023

INTRODUCTION

This supplementary ESMP produced for the proposed establishment of an IWRMC in Th. Madifushi address comments received from the EPA to the subject ESMP report, requested through letter 203-ECA/438/2023/76 (dated: 18 June 2023)

The report is prepared by the consultant of the original report, Mr. Ahmed Hassaan Zuhair, the ESS Specialist of the MCEP-PMU.

1. Need to clarify mechanism for waste transportation to the regional waste management facility after operationalization of the IWRMC.

The regional collection and transfer system will not be covered through MCEP under the World Bank financing, but is planned to be established through GoM co-financing. As such, funding for procuring 3 transfer vessels have been proposed for 2024 government budget.

The feasibility study for establishing a regional solid waste management system in Zone 4 and 5 (FS) is being prepared under MCEP and the report is currently at its final stage of preparation, with the report expected to be finalized and disclosed in August 2023. The FS will provide details of the regional collection and transfer system and RWMF for treating residual waste collected from the islands (waste that cannot be treated at island level).

As per the FS phase 1 report and the draft full FS (March 2023), the subject facility will be Zone 3 RWMF (Thilafushi), which is currently in the process of being developed into a contemporary facility via the Greater Male' Environmental Improvement and Waste Management Project (GMIMWP) funded by the ADB. This regional facility will primarily use 2 waste to energy (WtE) plants of 250 tons per day capacity and ancillary facilities for treating the residual waste coming from the islands. The project is expected to be completed and the regional facility made fully operational by mid-2025.

The FS also has considered the option for developing a transfer station (TS) for Zone 4 and 5 (subject to availability of funds from GoM) in Dh. Hulhuvehi as a medium – long term strategy, subject to availability of the required financing.

The FS has considered 3 strategies for establishing the regional collection and transfer system. The short-term and medium-term strategies are summarized below:

Short-term Strategy (2023 - 2024)

During this transition period waste can be accepted in any kind of forms (loose, etc.) in Thilafushi and islands could organize periodical transport (every 3 - 6 months) on a direct haul of residual waste with the support of WAMCO (if budget for the 3 vessels proposed for 2024 gets endorsed) or private operators (Dhonis). Furthermore, if a regional transfer system is not in place, the Island Council can explore the possibility of tapping into the recently approved monthly disbursements to be provided to the Island Councils as operational waste management support through the Maldives Green Fund, subject to acquiring no-objection from MoECCT.

On a short-term perspective (2023/2024) in case of incoming additional waste from Zone 4&5 it will not affect the capacity of the WtE as this structure will be only operated in 2025. Residual waste arriving from Zone 4&5 will be processed (shredded/baled) and will increase the buffer elements for the WtE as when the facility starts waste bales will be used as a buffer to fill up the capacity.

Mid-term Strategy (2024 – 2029)

Depending on availability of funding, design, build and operation of the TS identified in Dh. Hulhuvehi and procurement of subsequent equipment and vessels (including complete prerequisite studies such as detail design and ESIA).

Increase frequency of collection for small islands to every 3 months and mid-large sized islands to every 2 months. Madifushi fall under the cluster of medium islands.

Once the WtE at Zone 3 RWMF becomes operational in mid-2025 only incoming residual waste in containers, closed receptacles (jumbo bags, compacted, baled etc.) or similar will be accepted.

2. Need to clarify whether there are any plans for one-off waste stockpile removal from the island prior to operationalizing the IWRMC.

The legacy waste at the island will be cleared prior to operationalization of the IWRMC if funding gets arranged. Alternatively, the Island Council can explore the possibility of tapping into the recently approved monthly disbursements to be provided to the Island Councils as operational waste management support through the Maldives Green Fund, subject to acquiring no-objection from MoECCT.

3. Cost of mitigation measures (where applicable) need to be provided in estimated numerical figures.

Cost estimates for ESMP implementation during construction phase and operational phase are already provided separately in the report in Section 6.7. table 33 and table 34.

4. Monitoring submission frequency and schedule with tentative dates need to be provided

The monitoring frequency is already reflected in the report in table 35 under section 6.8. Interim monitoring reports will be prepared on a monthly basis and a consolidated ESMP monitoring report will be prepared after completion of civil works and submitted to EPA.

The contractor is expected to remobilize to the site on 2 July 2023. Civil works are expected to be completed within 6 months from the date of mobilization. Therefore, the monitoring report is expected to be submitted on January 2024. The center operations responsibilities lie with the island council. The center is expected to be made fully operational by April 2024 upon delivery and commissioning of the equipment and registration at the URA, therefore, the

operational phase monitoring report is expected to be submitted by the island council on November 2024 (6 months into full operations).

5. Indicators and parameters for monitoring need to be more specific and reflect the impacts discussed in chapter 4 of the report.

Updated table 35 with further details is provided below. The updates are provided in blue ink.

Aspect	Parameter	Frequency	Responsible Party	Cost Monitoring (MVR)	of
Construction Phase					
Implementation of mitigation measures during construction	<p>Records of successful implementation of mitigation measures.</p> <p>This will be monitored through the monthly contractors monitoring reports that will be weighed against the interim ESMP monitoring reports. Interim ESMP monitoring reports will be prepared through the Kobo Toolbox platform the project has created and ground level data will be collected by the supervision consultant of the project.</p> <p>Interim payments of the contractor will only be processed after confirming that all the required mitigation measures were followed. If any issues are noticed, interim payments will be withheld until proper remediation actions are being taken by the contractor and confirmed via photo graphic references or visit to the site.</p>	Monthly during construction period	Contractor MCEP	<p>Covered under the supervision consultancy.</p> <p>NOTE: Total expenses for planned trips to Madifushi (6 trips) under the supervision consultancy is MVR 34,962.</p>	
Groundwater Quality	<p>Visual observations and perceptions of nearby residents. Salinity, smell, colour of water of the groundwater well within the IWRMC</p>	Twice during construction phase	Contractor MCEP	<p>Covered under the supervision consultancy.</p> <p>NOTE: Total expenses for planned trips to Madifushi (6 trips) under the</p>	

				supervision consultancy is MVR 34,962.
Grievance	<p>Log records of number of complaints received and actions taken during construction phase.</p> <p>Refer to section 6.10. for details. Furthermore, records of grievances received and actions taken will be checked during the monthly site visits undertaken by the supervision consultant.</p>	Throughout the construction phase	<p>Island Council</p> <p>MCEP</p>	<p>Covered under the supervision consultancy.</p> <p>NOTE: Total expenses for planned trips to Madifushi (6 trips) under the supervision consultancy is MVR 34,962.</p>
Operational Phase				
Implementation of mitigation measures during operations of the IWRMCs	Records of successful implementation of mitigation measures.	6 months after commencement of operations	Island Council / IWRMC Operator	Included in Operational Cost
Spillage Assessment	<p>Waste Collection Arrangements</p> <p>Littering around the island (Beach, harbor area and other public areas)</p> <p>Spillage during transfer to IWRMC</p> <p>Any Spillage within the IWRMC</p> <p>Proper use of IWRMC</p> <p>Spillage during transfer to regional waste facility</p>	Once when the project is completed and one year after project completion	<p>Island Council / IWRMC Operator</p> <p>RWMF Operator</p>	Included in Operational Cost
Groundwater Quality	Visual observations and perceptions of nearby residents. Salinity, smell, colour of water of the groundwater well within the IWRMC.	6 months after commencement of operations	Island Council, IWRMC Operator	Included in Operational Cost
Grievance	Log records of number of complaints received and actions taken during operational phase	Throughout the operational phase	Island Council	Included in Operational Cost

ANNEX 11

EPA's Decision Statement



DECISION STATEMENT

مذكرة قرار بشأن الموافقة على خطة الإدارة البيئية والاجتماعية

APPROVAL OF THE ENVIRONMENTAL MANAGEMENT PLAN

رقم القرار: 203-ECA/438/2023/78

مذكرة قرار بيئية صدرت من قبل وكالة حماية البيئة المصرية بشأن الموافقة على خطة الإدارة البيئية والاجتماعية المقترحة لمشروع إنشاء مركز لإدارة النفايات والموارد على جزيرة ماديفوشي، تها أتول، والذي تم تقديمه للتقييم في 11 يونيو 2023 وتم تقديم معلومات إضافية في 19 يونيو 2023 من قبل وزارة البيئة، تغير المناخ والتكنولوجيا. الخبير البيئي لهذا المشروع هو السيد أحمد حسان زهير.

This Environmental Decision Statement is issued for the purpose of communicating the decision regarding the Environmental and Social Management Plan for the Proposed Establishment of an Island Waste and Resource Management Center (IWRMC) at Madifushi, Thaa Atoll, which was submitted for evaluation on 11th June 2023 and submitted additional information on 19th June 2023 by Ministry of Environment, Climate Change and Technology. The environmental consultant of this project is Mr. Ahmed Hassaan Zuhair.

1. This Environmental Decision Statement has been issued on behalf of the Environmental Protection Agency (hereinafter referred to as the Ministry) pursuant to the Environmental Impact Assessment Regulations 2012 (2012/R-27) to advise that the Ministry has decided that the proposed project can proceed according to the Environmental Management Plan.

1. مذكرة قرار بيئية صدرت من قبل وكالة حماية البيئة المصرية على اسمها في إطار تنفيذ لوائح تقييم الأثر البيئي لعام 2012 (2012/R-27) لتوصي بأن الوزارة قد قررت أن المشروع المقترح يمكن أن ينفذ وفقًا لخطة الإدارة البيئية والاجتماعية المقترحة للمشروع.

(Handwritten signature)

مذكرة قرار بيئية صدرت من قبل وكالة حماية البيئة المصرية بشأن الموافقة على خطة الإدارة البيئية والاجتماعية المقترحة لمشروع إنشاء مركز لإدارة النفايات والموارد على جزيرة ماديفوشي، تها أتول.

Proposed Establishment of an Island Waste and Resource Management Center (IWRMC) at Madifushi, Thaa Atoll



- a) This Environmental Decision Statement has been withdrawn or;
 b) There has been a breach of the conditions of this Environmental Decision Statement.
- iv. It is the Developer's responsibility to undertake all project activities in accordance with the relevant laws and regulations of the Maldives.
- v. The Developer is aware that under the National Environment Protection Act (Law no. 4/93) and the Environmental Impact Assessment Regulations the Ministry reserves the right to terminate any activity without compensation if found that such an activity has caused significant, irreversible impacts on the environment.
- vi. All mitigation measures proposed in the EMP report for all the phases of the project shall be fully implemented.
- vii. The date of expiry stated in this Environmental Decision Statement is the duration given to commence the project activities approved under this Environmental Decision Statement.

ދިވެހިސަރުކާރުގެ ގެޒެޓްގައި ބަޔާންކުރި ބައެއް ސަރުކާރުގެ ފަރާތްތަކުން ހުށަހަޅާ ފަންޖަރު

Proposed Establishment of an Island Waste and Resource Management Center (IWRMC) at Madifushi, Thaa Atoll

